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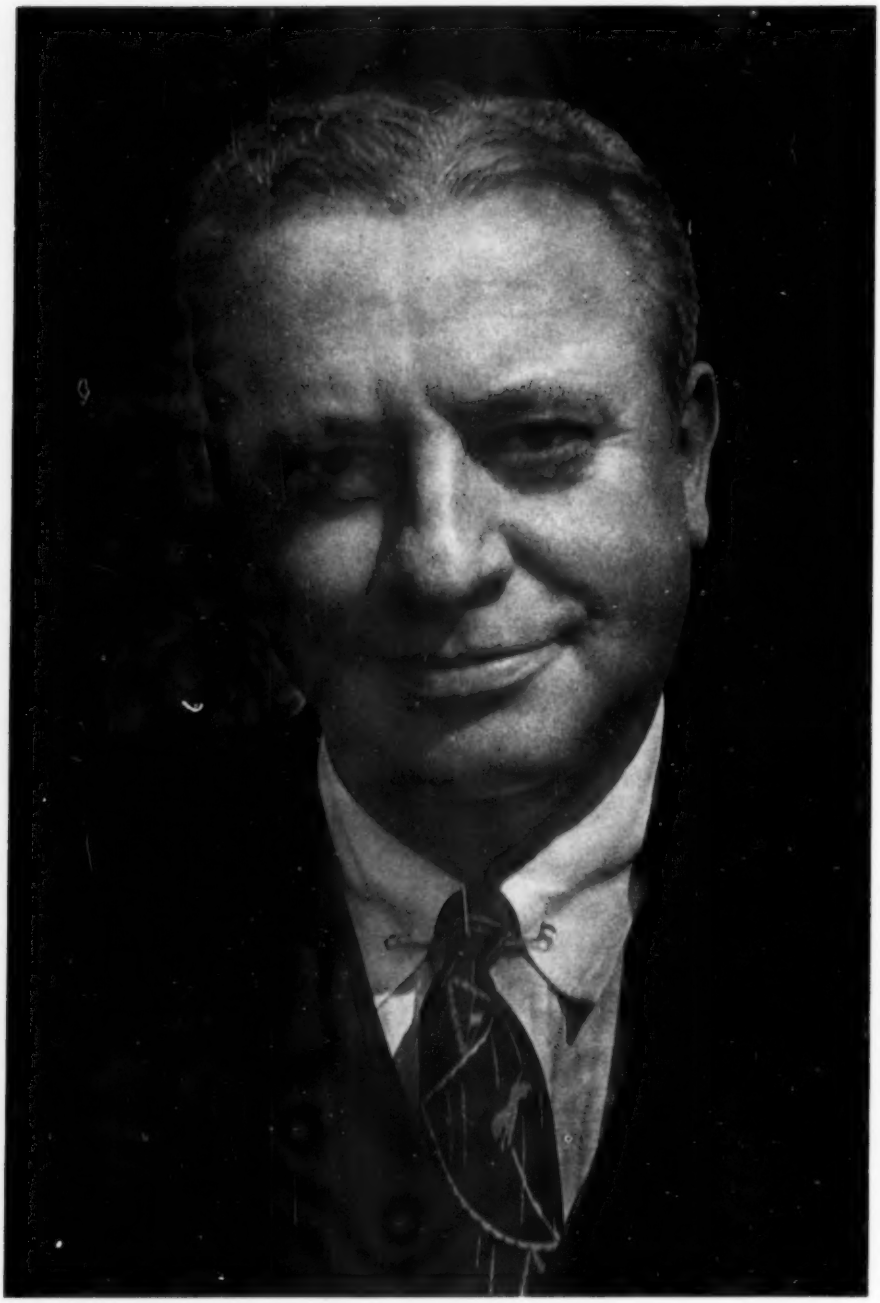

JOHN FARQUHAR FULTON
1899-1960
(Photograph by Gregory Zilboorg, 1953)

John Farquhar Fulton

JOHN FULTON was a member of the Board of Editors of this *Journal* from its founding in 1946, and was Editor from 1951 until his death in 1960. We need not be reminded of his own achievements as a medical historian. Less evident, because his assistance to others was accomplished with modesty as well as generosity, were the encouragement and advice he offered to students and colleagues who undertook research in the history of medicine. He shared their excitement, gave counsel in their dilemmas, read their manuscripts, and helped to bring their final drafts to publication. He saw the *Journal* as an essential instrument for the pursuit and enjoyment of medical history, and gave to it gladly and freely of his crowded hours, his skill, and, on occasion, his material support. Because of him, the torch burns brighter in the hand of many a scholar across the world. John Fulton could have echoed William Harvey: ". . . I can indeed say that I have used all my endeavours, bestowed all my pains on an attempt to produce something that should be agreeable to the good, profitable to the learned, and useful to letters."

T.R.F.

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John Fulton—Book Collector, Humanist, and Friend*

ARNOLD MUIRHEAD**

LITTLE did I imagine that the request of a young American girl, met by chance at an uncle's house in Hampstead one July evening in 1921, to look up an American Rhodes Scholar going up to Magdalen that October would bring me the closest and most enduring friendship of my life and color its whole pattern. But so it was to turn out. I dutifully made my way down to Magdalen the second Sunday of term. Although it was, I remember, a beautifully mellow autumn afternoon, I found John Fulton in a dressing gown in front of a fire trying to overcome the chilly dankness of his room in the New Buildings overlooking the Deer Park. I introduced myself, and the book he was reading and the other books in the room seemed to forge an immediate link. I remember too being extremely impressed at noticing reprints of several papers by John himself, and rather ruefully having to admit that I had nothing more than a few magazine contributions to my name. I think we took to one another at once, and the inevitable invitation to breakfast I extended before leaving was given and accepted with a mutual sense of expectation.

I was then in my third year at Brasenose, and so living out of College. Neither I nor my landlady had entertained Americans before, and there was no jug of water on the table. John, with that impatience I was to discover to be so typical of him, finding his coffee too hot, unhesitatingly cooled it down from a siphon on the sideboard. To add a further shock, he proceeded to eat marmalade with his bacon and eggs. But his charm and his enthusiasm over my books won me completely. We both had books and pictures, and for a time were to imagine each was better off than was actually so, but there soon came a time when the minuteness of our bank balances was to our mutual amusement

* Rather than attempt to cover in the necessarily limited scope of a single paper the whole of John Fulton's adult life, I thought it preferable to write in greater deail of the years 1921-1939, and particularly of the earlier formative years at Oxford and Harvard, which, because they will be less familiar to many, may for that reason perhaps be of special interest. The paper is based on personal knowledge and diaries, and letters and other memoranda written by John Fulton to me. I can only hope that the personal note is not too obtrusive. *A.M.M.*

** 19 Welclose Street, St. Albans, Herts., England.

discovered. From then on we met with increasing frequency, mostly in the evenings, for John being a scientist often had to work in the labs in the afternoon, and we would sometimes cut Hall and dine at the George or one of the small mushroom restaurants that had sprung up after the War. John never did much at games, although he was a good long jumper, but we walked and went on the river, and he first took me to Lady Osler's for tennis. John's idea was always to get as much exercise as possible in the shortest time: this did not matter so much in singles, but in doubles he was an inveterate and unashamed poacher. Later on in America when he began to put on weight, he tried squash with Lucia, but he confessed that writing a paper on Harvey against time lost him more pounds than the hardest game of squash. In the end he gave up and stuck to walking.

"Open Arms," as 13 Norham Gardens, Oxford, had long been affectionately and widely known, had such a far-reaching and permanent effect on our lives and our book collecting that I make no excuse for dwelling on it in some detail. Lady Osler, after Sir William's death in 1919, had continued to keep open house and to receive the countless visitors who came on an Oslerian pilgrimage, so when John arrived with a letter of introduction, he was warmly welcomed, invited to stay to meals and to use the library and tennis court, and to bring a friend. It turned out that she knew an aunt of mine well, and it was not long before John and I were advanced to the privileged status of "latchkeyers," which virtually gave us the run of the house and of the library in particular. At this time Dr. William Willoughby Francis was compiling the catalogue of *Bibliotheca Osleriana* preparatory to its final remove to Montreal, and John and I vied with one another in helping to verify bibliographical details at the Bodleian and elsewhere. It is not hard to imagine the devasting effect of this large and rich library on two impressionable and already bookish-minded undergraduates. In one way it obviously meant more to John than to me for he was studying physiology as a preliminary to completing a medical degree, while I, after a strictly classical education, was reading for the newly established school of "Modern Greats"; but even I was dazzled by the Sir Thomas Browne collection, the presentation Kiplings, the magnificent reference books, and was prepared to dip into the "Biographia" and "Litteraria." It was a magic atmosphere for us, and Bill Francis always seemed to have time to discourse learnedly and enchantingly about volumes he was cataloguing or to reminisce about the

"Chief." He was a born and humorous raconteur with a prodigious memory, and he was kindness itself to both of us. It gave John enormous pleasure in later life to become a trustee of the Osler Library, and he made a point of attending the meetings in Montreal and renewing his affectionate contacts with its librarian.

Lady Osler, having lost her husband and only son, was a lonely woman, and her two main interests were the completion of the library catalogue and her "young men," on whom she lavished the affection that would otherwise have been devoted to Revere, and she saw to it that they had a chance to meet some of the distinguished doctors, scientists, and others who came to the house in a constant stream. In some indefinable and miraculous way the spirit and example of Osler were kept alive. We knew, I think, his *Way of Life* by heart, and modelled our own days upon it, boasting of our "cerebral control," and if, before, our interest in antiquarian books had been slight, we soon became confirmed bibliomaniacs.

For John there were profounder effects also. When after taking his finals he decided to stay on at Oxford and read for a D. Phil., it was agreed that his marriage to Lucia Wheatland (her family had been in Oxford all summer) should take place in Oxford to save the return to America and back. John himself was married from 13 Norham Gardens, and I shall never forget how he and I, his best man, were driven to Manchester College Chapel in the back of Mrs. Chapin's open "Fordie" with Mrs. Chapin* at the wheel and Lady Osler by her side, both sitting bolt upright in true Bostonian tradition. When Lucia and John returned from their honeymoon to take up a two years' residence at 4 Bradmore Road, just round the corner from "Open Arms," Lady Osler took Lucia under her wing and initiated her into all the mysteries of University social life, shopping in the market, and so forth. Mill Rock was never a slavish copy of "Open Arms," but the spirit that animated it and made it equally famous and beloved owed much to the lessons and atmosphere Lucia and John had imbibed in those formative years in Oxford.

There never was any doubt in the minds of those who knew John at this time that he was an outstanding personality with exceptional ability and powers, who was certain to make his own significant contributions to science and by his example greatly influence others as well. One was immediately struck by his dynamic

* Mrs. Henry B. Chapin of Boston, Lady Osler's sister.

energy, his intellectual powers, his quick grasp of essentials and his ever-questing mind. When John and I spent four weeks of the last vacation before our Finals together in Devonshire, I had a chance to learn at first hand more about the way he worked. His powers of concentration were phenomenal; he could read for ten hours a day without wilting, and he remembered all he read. In fact, his concentration was such that words often failed to rouse him and some actual physical interruption was necessary, when he would then stammer and take a moment or two to realize his surroundings. Many will recall his stammer when he was excited over a book or an unexpected present. He told me he had stammered quite badly as a boy and had been taught to whistle before he spoke to help cure himself. Like true disciples of Osler we read our favorite authors for half an hour before retiring. John fell asleep as soon as his head touched the pillow, and he rarely dreamed or was restless. He sprang out of bed immediately he wakened and exercised vigorously for five minutes. His range of interests and general knowledge was wide, and a word or an allusion was enough to start him off on some fascinating recital. He had a supreme power of clear thought and lucid expression, and he taught me what little science I know. An interest in pictures nurtured by his father-in-law, Richard Wheatland, and also stimulated by Sir Charles Sherrington, whose pupil he was, remained an abiding joy to him; later, on his wide travels in Europe, he returned again and again to galleries to see old favorites, and he never missed a chance of seeing new pictures if opportunity offered. When he was in Russia for a conference he visited The Hermitage five or six times during his stay. For all his "cerebral control" there was a tender, romantic vein in him, and he could be deeply moved by the lovely interior of some cathedral, by a commemorative service, or some affecting passage in a book, and tears would stand in his eyes.

This is not the place to tell of his scientific achievements, but the fact that, only three years after completing his medical degree and returning to Oxford as a Fellow of Magdalen, he should at the early age of thirty have been called to a chair at Yale, speaks volumes for the impression he had made. Later he could have returned to Oxford, and it must in one sense have been a hard decision to refuse, for so often in his letters he wrote, "I yearn for Oxford." But he was an American, educated in America and he believed it was his duty to devote his most productive years to his own country.

Environment probably plays the largest part in making the book collector. I have already written of the Oslerian impact, but the influence began earlier. He once told me that he thought it was insufficiently appreciated how important it was for fourteen- or fifteen-year-olds to have teachers interested in their pupils, and that had it not been for one teacher of English in particular he would probably have chosen some quite humdrum calling. As a boy of fifteen he had made extra pocket-money by shelving books in the St. Paul Public Library, and it gave him enormous pleasure twenty years later, when delivering the Herter Lectures on the Frontal Lobes at Bellevue Medical College, to note that its librarian was the Miss Helen Bayne who had been a fellow worker in this first job. His bookish leanings also received family encouragement, which the Harvard libraries must have increased. His tutor, Harold Laski, was a book collector, and John always spoke warmly of the stimulus received from him. But it was coming to Oxford that gave him the first real chance and impetus to collect *old* books, and the proximity of bookshops such as Blackwell and Parker, with visits to Cambridge and Edinburgh, made temptation irresistible. The news I sent him of the bookseller David's death recalled the purchase from him of his first Sir Thomas Browne—the 1686 folio—for twelve shillings when he was staying at Cambridge in 1922 with Sir Arthur Shipley. It was in the summer vacation of that year when working in Sir Edward Sharpey Schafer's laboratory in Edinburgh that he laid the foundations of his Boyle collection. Laski had told John that any educated man should have read Boyle's *Sceptical Chymist*, and he had promptly, October 1919, bought the Everyman edition, which remained with him till his death: he was also encouraged to collect Boyle by his brother-in-law, David Wheatland, who was himself to become a noted collector of scientific books. So in Edinburgh he spent much of his leisure in the second-hand bookshops, and in one, where the shelves were so crowded that the books were in rows three deep, he found in the back row Boyles at one shilling and sixpence each. Because Boyle was at that time unregarded and the prices very low, he rashly concluded that the booksellers might be ignorant about other books as well. He received a rude and salutary jolt when in reply to his *innocent* inquiry about an unpriced volume he was told the price was one hundred and fifty pounds. It was typical of John that he told this story against himself with a chortle. However, he did also that summer in Edinburgh buy a first edition of Locke's *Essay concerning Humane Understanding* 1690 for thirty

J. F. working at his table in the Surgical Laboratory of the Peter Bent Brigham Hospital on a manuscript. Photograph taken by Dr. Harvey Cushing in 1928.

J. F. and Lucia Fulton in London in August of 1955 after the wedding of one of the three British children who lived with them during World War II.

shillings. One can picture John getting at those back rows. A doctor collector friend once said of me, "You should see Arnold tearing the heart out of a bookshop." With John in his heyday I was not in it. No dust or filth deterred him, no ladder was too precarious to daunt him. The highest and lowest shelves always received special attention. His energy and determined meticulous examination were alike inexhaustible. Like his friend, "Lefty" Lewis,* he seemed to have a sixth sense and to know instinctively if there were some treasure waiting for him. Nothing ever annoyed him more than to have books brought him singly for inspection from some hidden recess or basement to which he was not allowed access. He, perhaps unreasonably, wanted to examine these caches with his own eyes. I well remember his angry explosion (no other word describes it) in a London bookshop when treated in this way by a foolish assistant. It was only in later life when increasing weight made stooping or climbing difficult and he had developed an allergy to book dust that he examined the shelves more gingerly and was more content to have special books brought to him. Reginald Hill, then of the Bodleian, has a nice story of going into Blackwell's one day in 1924 and asking when they intended issuing another catalogue of antiquarian medical and scientific books and receiving the reply, "Whenever we manage to get a few good books together, a fellow called Fulton comes along and buys the best of them."

His early letters are full of his finds—lesser as well as major. "In an old clothier's shop at Minehead a superb copy of the second edition of Boswell's Johnson with an A.L.S. from Seward for seven shillings, and a crisp copy in original calf of the 1514 editio princeps of the Aldine Quintilian for two bob!" When I was due to arrive at Bradmore Road a day before his return he wrote, "You will find when you arrive some packages of books denoting our itinerary. You can open any or all of them if you wish, but keep them in piles." He knew I would be itching to undo the string and generously allowed me the pleasure of unpacking the parcels. A fortnight later after a further holiday in Paris he returned, I noted at the time, with fifty precious volumes.

His marriage made it possible for him to collect books in a more extended way, and he was indulged as few book-collector husbands can ever hope to be. His father-in-law, Richard Wheatland, also gave him generous sums to spend on books, although even he at times shook his head and told John he was madly pur-

* Editor of the Walpole Papers.

suing a rich man's hobby. For John the most important room at 4 Bradmore Road was, of course, his study. Any available wall-space not shelved was hung with framed prints and portraits of famous doctors, scientists and members of the Royal Society. Over his desk was a print of Sargent's portrait of Sir William Osler. He had typically devoted certain wedding checks to buying the complete *Oxford English Dictionary* and complete *Dictionary of National Biography*. When he returned to Oxford in 1928 and settled at 29 Charlbury Road, these were housed in the dining room in a special case with a reading desk above for convenient reference, and it was nothing for John or a guest to get up in the middle of a meal to consult a volume. "The flighty purpose never is o'ertook unless the deed go with it," a favorite quotation of Osler's, was always ready on John's lips also. (Characteristically, John and Lucia gave me a complete set of the D.N.B. when I got married.) Biographies and diaries had a perennial fascination for John, for he had a deep reverence for all the great figures of the past in medicine, science, and literature, and especially loved the small intimate details and idiosyncrasies that revealed the man and was never tired of recounting them. When the *Dictionary of American Biography* was started, John was commissioned to write a number of lives of medical and other worthies, notably that of Joseph Priestley whose books he collected in all editions and a useful handlist of which he compiled for private distribution. The restricted limits of these commissioned lives, and the short obituaries of famous scientists prepared, often at short notice, for journals, suited him better, I think, than the larger canvas. His biography of Harvey Cushing was modelled too largely on Cushing's own Life of Osler and, although an admirable tribute, seemed to suffer from an excess of material. With his shorter notices he could always be depended on for a shrewd and succinct appraisal of achievement and a warm appreciation of the personal qualities of his "subject." In fact, the art of the short biography appealed to him enormously, and he confessed that when he opened *The Times* he instinctively first turned to the obituaries. "That was such a nice notice about so and so," he would write, and one would like to think that from the Elysian Fields he read and approved and perhaps "blushed at" (a phrase he used when praised) the warm and sympathetic tribute that appeared about himself. And on the exceptional occasions when an obituary appeared prematurely, he chortled wickedly and wondered if the *subject* had read it. For *The Times* he had great regard and respect, and

I was severely taken to task because I once wrote *the* Times. John liked literary dignity and thought this was a quality singularly lacking not only in American journalism but in much of American prose as well. "Some day I should like to write something for the *Atlantic* on the subject—contrasting English and American prose."

In the autumn of 1925, having received the degree of Doctor of Philosophy with the thesis published a year later as the monograph *Muscular Contraction and the Reflex Control of Movement* (Baltimore, 1926), he returned to America to complete his medical degree at Harvard. Before he sailed he had secured in Paris that July one of his major early finds—the very rare first edition of Paré's *Anatomie Universelle* 1561. In December 1923 he had carried to Paris at Lady Osler's request the copy of this book which Sir William had willed to the Faculté de Médecine, a coincidence that appealed to him. When he returned to the same shop four years later, he found that they had learnt about Paré meantime, and that a choice copy in pristine state of his *Oeuvres* 1581 was marked eight thousand francs. "So I departed envious and empty-handed."

Back in America they settled at 126 Longwood Avenue, Brookline, and in September he wrote to me: "We've chosen an apartment on the basis of extensive wallspace and sunlight—with an outlook unusual in America, namely green gardens both in front and behind. I'm having bookshelves built eight shelves high and fourteen feet long which if books average 1.44 inches in thickness ought to take just 1000 books—this will relieve the congestion in my other shelves. Shall have a front 'den' off the (small) drawing-room for the history of science and medicine. Then also a back study for Work books. Shall try to arrange everything biographical in the dining-room." One wonders what room Lucia had left.

At this time he was seeing a great deal of Leonard Mackall, probably one of the most learned and generous bookmen of all time. "Leonard has just spent four days with us—very interesting but most exhausting—sales catalogues, mistaken references, rare volumes, large paper copies. I am dreaming of them." Then there was Dr. Streeter—"have I mentioned Dr. Streeter to you? A man of great intellect and rare personal charm deeply read in all aspects of mediaeval life. But most attractive of all he is a bibliophile. Seven or eight of us meet at his house on Thursday evenings at eight, ostensibly to study mediaeval anatomy—actually to hear the most fascinating informal discourses on life in the Middle Ages illustrated with MSS and early printed books." His days

at this time must have been unbelievably full with his medical studies, the preparation of his monograph for the press, and with other papers. By the end of 1928 the collected reprints of papers he had published already numbered fifty, all based on the scientific work he was doing with the exception of his first historical paper, "The Early Phrenological Societies and their Journals," read to the Boston Medical History Club, on 28 January 1927. But as he wrote, "What is the use of living if occasionally one does not *bite off* a little too much?" It was true he had a part-time secretary, a rare luxury for a medical student, and he must have been one of the earliest private users of a dictaphone (bought in October 1927), and he boasted that he dictated for three or four hours each evening. Later he was to carry one about with him on his travels when attending conferences and was thus able to make extensive records of papers and happenings while they were fresh in his memory. Not only did he employ secretaries in London, Oxford, and Paris, but he continued to bombard his hard-worked secretaries at home with discs and tape-recordings. This was one of the secrets of his phenomenal output of books, papers, and correspondence. It amuses me now to read in a letter of 1926: "George Washington was an excellent fellow, for his birthday is giving me a day of leisure in which to write to you and to read Christie's *Etienne Dolet*," and his later secretarial staff would have smiled rather ruefully to read such words. For it was not long before he was abominating and fulminating about the time wasted by public holidays and cajoling and bribing his secretaries, or at least one of them, to come in and work for him. In fact, he changed in other ways over the years. The Harvard medical student who wrote "I had a very delightful fishing and camping holiday in the woods (of Maine)—my first experience with fly-fishing and I succeeded in catching several large trout, and I longed for my facsimile edition of *The Compleat Angler*," could not twenty years later be persuaded to stay more than a day in the countryside even though there was a friend's library to console him, for he suffered acutely from hay fever, and he always tried to avoid being in America when the ragwort was at its most virulent. The later, much travelled, sociable bon-vivant might also have smiled to have recalled to him a paragraph from a letter in 1924: "The last two weeks have been hideous. Am so glad to be getting away from it all. Entertaining and going-out, I fear, are not my forte. I envy Montaigne's existence with his study in a tower which no one dared enter, and in which he cultivated himself, in true Socratic

fashion." In that same letter he wonders what Sir Thomas Browne, who called it a tragical abomination to be knaved out of our graves, would have thought of Sir Arthur Keith's monograph on his skull and the ceremony of its reinternment.

John was always an early riser and was apt to be impatient with those—especially guests in his own house—who liked to breakfast at nine, and then linger over the papers, when he was itching to get off to the lab or library. The arrival and reading of the morning's mail was always a highlight of the day, and he took great pains to see that its receipt and despatch of replies were as expeditious as possible. In the early Oxford days there was a letter collection at 1 *a.m.* which delighted John, for he could dine out in Oxford or London and write and post a thank-you note which would be on the breakfast table of his surprised hosts of the previous evening. Before transatlantic air mail was instituted, he took great care to mark his correspondence to go by a named fast boat. "Your letter came by a slow ten-day boat," he would write reproachfully, and for a while one would study the shipping notices in *The Times* more carefully, so that he could write on another occasion, "Your letter came in record time." This may sound almost too trivial to record, but it was part and parcel of John's eagerness to get things done and not waste time and to keep in punctilious touch with his countless friends all over the world so that they felt they were his immediate and special concern. He certainly had a genius for friendship. By the same token, he preferred flying—by jet if possible—to any other form of transport.

When John returned to America in 1925, I think he had already made the private resolve to build up a great personal library of medical books. At any rate, by 1928 he wrote, "My purpose in collecting is to acquire a reference library which will make me independent of the larger collections while writing a historical treatise of physiology." When in 1935 the "Trinitarian scheme" was bruited, he again could write:

> Dr. Cushing's library is a much richer and more unified collection than that of Osler, it being especially rich in the early English and the early incunabula period. Klebs's collection, though less rich in rarities, is in some ways almost as remarkable on account of its wealth of material on fifteenth century books. My own collection is the only extensive library on the history of physiology, in the broad sense, that has been brought together privately, so that it will supplement the other two without extensive overlapping.

How remarkable his own library already was by this date is indicated by the fact that he was able to give Donald Wing five hundred titles for his Wing period 1640-1700. There is no doubt too that although John continued active and valuable original research for some years, more especially during the War, his interests were turning more and more to medical history, and this same year he wrote: "A.C.K. [Klebs] is chiding me for my interest in medical history and bibliography, saying I should drop it for ten or fifteen years when I am *gaga* as he is!" Once the Trinitarian scheme was accepted in principle, there was a most sensible agreement not to encroach on each other's special fields of collecting, so that any further duplication would be avoided. The story of the scheme has been told—in outline at any rate—in the fascinating volume, *The Making of a Library,* presented by his friends to John on his sixtieth birthday and needs no further gloss from me. The vision, the determination in the face of disappointing delays, and the selfless generosity of the three collector friends have made the Yale Medical Library one of the greatest in the world and have put all future students of medicine in their debt and given them untold riches.

John liked to put his books to good use, and nothing gave him more pleasure than to arrange some special exhibition to celebrate a centenary or some other anniversary. Many a Sunday he devoted to arranging such a display. And not only his own books. In November 1931 he wrote, "My first official duty as Curator of rare scientific books in the new Sterling library was to plan an exhibition illustrating the history of science for a meeting in New Haven of the National Academy—a fairly good collection but there are many gaps which I hope we shall be able to fill when times become a little better." He took books to his lectures to show his pupils or when he was reading a paper to some Society. "Last night I read the enclosed paper to an extraordinary society known as the 'Ladies Aid'—an interesting group of about twenty senior people, chiefly obstetricians. It is a dining club which meets once a month and it is apparently their custom to have an informal paper afterwards. I brought a suitcase of books and passed them around during the paper."

In 1933 he arranged a weekly seminar for "anyone interested in books" in his Physiology Department. "The first few sessions will be concerned with the history of ancient bookmaking, the invention of printing, and with the principles of bibliographical description of books printed before 1700. The later sessions will

be devoted to the history and description of books important in the growth of physiology and medicine. Materials will be collected for an annotated bibliography of physiology." John himself started the session with "the humanization of bibliography especially of medical bibliography with a brief survey of sources." The book *anatomized* was Fracastoro's *Syphilis* 1530. Other papers were on the general anatomy of books, on Vesalius and the bibliography of his book. It is impossible to gauge the success of such an experiment, but enthusiasm is always infectious, and just as John had been stimulated by Sir Charles Sherrington's pulling out rare incunabula from an innocent-looking filing cabinet or by an evening with Geoffrey Keynes—"his books always stir me"—so we may be sure that some of his students felt the vital spark and were to become confirmed bookmen.

John was always a generous donor and lender of books, as many libraries and private collectors bear witness, and if he thought a volume deserved a worthier or more suitable home than his own library, he parted with it. Many of his book-collector friends have such precious volumes on their shelves. Usually when he gave away a book it was a *duplicate,* so called so as not to embarrass the recipient overmuch. When one gave him a book, he always made one feel that even an unconsidered trifle was a treasure. Here are two typical examples from his letters to me. In acknowledging Malcolm Flemyng's *Neuropathia* (York, 1740) he wrote (November 1931):

> I am simply delighted to possess it because Flemyng was one of the few English physiologists of the early 18th century and made a number of fundamental contributions in the field of neurophysiology. Among other things he seems to have been aware of the anatomical distinctness of sensory and nerve fibres. . . . The *Neuropathia* entitles him to a place among the pioneers of psychiatry and he appears to have had a very clear idea as to the importance of stress and conflict in the genesis of mental disturbance. One of the things that amused me most was the frequent references to Peter Shaw to whom the book is dedicated. He addresses him as "humanissime Shavi"! I wonder if Bernard has ever been so addressed! Heaven forbid! There are also a number of Rabelaisian touches in the poem clothed in the decent obscurity of the Latin tongue. I'm sure you ferreted them out and enjoyed them!
>
> [September 1933]: Jehoshaphat! If ever again you see anything bearing the title *Studies from the Physiological Laboratory* in the *University of Cambridge* for the good Lord's sake buy them: Only three copies are known, and they are the precursor of the Journal of Physiology having been edited by Michael Foster. They are priceless from the point of view of the history of English Physiology. You have sent me part III—some day

you may find parts I & II. Why don't you pop down to the shop in Brighton again & have another look [I did but there was no more]. . . . Well you certainly have given me a thrill!

Any account of John would be incomplete without a reference to the immense pains he took with all his writings and addresses. As usual, he modestly underrated his ability—here is a passage from a letter early in 1926:

The rapid development of your style makes me blush especially when I compare it with my own humdrum diction which remains stationary and uncouth. If ever I finish this irksome didactic work in medicine, I may then be able to turn my attention to the gentle art of writing. Being without early training, I feel the difficulty much more keenly. I only hope that a taste for good literature will one day show itself in writing—as it has with you.

He was always imploring me or some other friend to whom he sent a draft of a paper to watch out for the style and flow of the sentences. He loved to read out some passage from a book he was reading that appealed to him and savor its music and share it with you. He found the presentation of scientific papers at conferences in general pedestrian and often slipshod, and he never failed to express his appreciation of one that was outstanding for the clarity and logical sequence of its arguments and its choice of language.

In the preface to the first edition of his bibliography of Boyle John acknowledged the stimulus of Keynes's bibliography of Sir Thomas Browne in spurring him on, both to continue to collect Boyle's works and to prepare a similar bibliography, and he says much else in that preface about the problems that face the compiler of humanized seventeenth century scientific bibliography. But if I had to pick one quotation that seems best to sum up John's attitude, method, and breadth of vision in this difficult art, I would choose the closing paragraph of a paper he read on 6 May 1935 to the American Association of the History of Medicine, entitled "Relation of the work of Richard Lower and John Mayow to the scientific thought in the seventeenth century," his bibliography of Lower and Mayow having just been published by the Oxford Bibliographical Society. The final paragraph of this (apparently) unprinted paper "embodied the thought I have been attempting to put into words for a long time but never previously succeeded in doing," and reads as follows:

I hope that this bibliography may not only convey the idea that John Mayow was a lesser, and Richard Lower a greater figure than has been commonly supposed, but the larger thought that scientific ideas should be

considered in relation to the soil from which they grew. The man himself—the seed—will always be important, but he cannot be fully understood without knowledge of the intellectual and spiritual forces that nourished him and gave him his full stature. These forces—which constitute the soil—can be recreated in large measure through bibliography, humanized bibliography, if you will, in which the primary objectives of study lie not alone in detailed bibliographical anatomy, but in the more intimate features of a book: its dedication, inscription, owners, preface, footnotes, addenda, and errata, not to mention textual changes in its various editions; these, the more personal attributes of a book, reveal the man who wrote it, the forces which shaped his work, and the audience which he strove to inform. And when bibliographical study is made of a work such as Richard Lower's *Tractatus de Corde* which has been passed from one generation to another and through the hands of many editors and translators, one is able to estimate the extent to which a seed, richly endowed by nature and environment, has influenced the soil from which we ourselves have sprung.

The rest of the story of how John gravitated more and more to medical history and bibliography, and of his resignation of his Chair of Physiology to become the first incumbent of the Chair of Medical History at Yale, and of the final triumphant consummation of the "Trinitarian dream" must be left to another place and another pen. After my visit to America in 1939, I saw John less frequently, although we continued to correspond in the intervals as intensely as ever. When he came over in 1957 to receive an honorary degree at Oxford, he was very ill, and as I said good-bye to him at the airport I feared it was a final farewell. But he made a miraculous recovery and in the summer of 1959, after attending conferences in Argentina and Spain, he was in England again. He came down to St. Albans and seemed to have shed ten years. He was thinner, his eyes were as keen and blue and his mind as alert as ever and there was the eager zest as of old. He reminisced, joked, and looked at books in his own inimitable way, and it was a perfect day. On his return to America, presuming on his new-found strength, he drove himself too hard again, for he hated stagnation. He still planned and hoped to come over for the Royal Society celebrations in the summer of 1960 and to be present at my sixtieth birthday party. With his true genius for lasting and loyal friendship he wrote, "June 30th is a *sacred* date and I shall be there." Death alone prevented him.

John Fulton's Contribution to Neurophysiology

HEBBEL E. HOFF*

THE ten years that have passed since John Fulton retired from the chair of physiology to make the short but significant move to the Historical Library are easily bridged by those of us who knew him from the late nineteen twenties and early thirties, and whose image of him is based on years of close, daily association in the active, effervescent, and productive Laboratory of Physiology as it was under his chairmanship for almost exactly twenty years. But generations of medical students change every four years, and in ten only the most senior resident remains to give contemporary color to an image that must now be largely historical. That remarkably acute and effective means of communication from class to class has lost its immediacy and detail, and tradition begins to replace reality.

Often enough, then, the student begins to respond to tradition by asking: What was he really like? What did he really do? I well remember raising similar questions when, only nine years after Osler's death, I first encountered the Oslerian tradition at Oxford. Cushing's biography, six years at McGill, and many pleasant hours of reminiscence with William Francis have done much to bring his image into focus, but never with the clarity of those who knew him personally—even for a short time. I recall, too, the late months of 1931 (I believe it was) when it was known that Sir Charles Sherrington was to be awarded the Nobel Prize in Physiology jointly with Adrian. It was then commonly stated that the committee recognized finally that Sir Charles deserved the award, but found it difficult to formulate the award in terms of a concrete discovery. There must be some basis of truth in this story, because when the announcement was made, the prize was given for the isolation of the "single unit" of nervous activity, which can hardly be thought to represent the central core of Sherrington's contribution to neurophysiology.

The truth is, I suppose, that scientists and teachers are much like the fleets of which Mahon wrote: they contribute not alone by

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what they do, but by what they are. Osler and Sherrington were preëminently such; no list of their publications, no critique of their writings can encompass their real significance. John Fulton was another such person, whose influence in physiology and in medicine goes far beyond what he did. What he was and what he stood for are much the greater components of what constitutes his total position in physiology and medicine, and are the harder to communicate.

A few decisive influences turned Fulton to neurophysiology. From his earliest youth an omnivorous and retentive reader, he had an outstanding ability to scan an article or book—even in unfamiliar language—for its essentials, to place them in the perspective of history, and to remember the reference, even to page number. To this was linked an unusual generosity, amounting sometimes almost to a fault; credit was fully and freely given, all who had contributed were recognized with respect, and Fulton's bibliographical accuracy was never used to discredit another worker. Harvard College made him a scholar, turned him toward physiology, and brought him a Rhodes Scholarship. Oxford and her tutorial system developed his 'expertise' in expression and in experimentation. Sherrington confirmed him as a neurophysiologist. Here, in those days, was one of the great nodal points of neurophysiology. Sherrington, in his sixties, was master of the phenomenological study of neurophysiology, particularly as exemplified in the decerebrate cat, a preparation he had, to be sure, not invented but had so perfected and studied that it was virtually his own—and his pupils'. Now, with the light myograph and the string galvanometer, he was analyzing the phenomena he had earlier described in external outline in terms of the probable inner mechanisms of the component units of the nervous system. Direct study of most of these active units was yet beyond his techniques, but the inferences he drew, with their rich picture of afferent and efferent, and internuncial neurones, linked only via the apposition of delicate feelers at synapses, and the competing central states of excitation and inhibition, have borne well the revelations of the last thirty-five years of increasingly detailed and direct studies, which they in no small measure stimulated. As Charles Kettering has said, "A problem is not solved in a laboratory, it is solved in some fellow's head, and all the apparatus is for is to get his head turned around so he can see the thing right."

MUSCULAR CONTRACTION AND REFLEX CONTROL OF MOVEMENT

In this atmosphere Fulton found his first interest in skeletal muscle. It was, with its linkage to the motor neurone (Eccles and I first shortened it to motoneurone), the "final common path" of reflex and voluntary activity; through it were reflected the integrated activities of the nervous system. Herein lay its interest to Fulton; muscular contraction, correctly analyzed, was the spokesman for the nervous system. Fulton's first book, on *Muscular Contraction and the Reflex Control of Movement,* summarized these studies, carried out largely for his Oxford D.Phil., and those of the Oxford group on reflex control, which had not been gathered together since Sherrington's Silliman Lectures on *The Integrative Action of the Nervous System* in 1906.

Framed in a comprehensive historical framework, still a matchless source of historical documentation of muscle physiology, the work presented a review of the physiology of skeletal muscle as it was then known. The electrical behavior of nerve as it was just then being introduced by Erlanger and Gasser was invoked to elucidate the nature of the monophasic action potential of muscle. Chronaxie, the latent period of muscle, and the nature of the twitch and tetanus were well and clearly described, and the possible nature of muscular contraction discussed. The concept of the motor unit, the cholinergic nature of neuromyal transmission, and the contractile association of myosin and actin and their relation to the cross-striations of skeletal muscle were of course unknown at that time, and these chapters are read today with a real sense of appreciation of the power these three tools have brought to muscle physiology, but there is little in these chapters that is not still germane, excepting only an unfortunate over-emphasis on the "angle"— an abrupt termination of the contractile phase of the graphic record which ushered in the downward decline of the myogram of the relaxing muscle—which not too long afterward was shown by other workers in the laboratory to be an artifact caused by friction of the bearing surface of the torsion wire myograph then in use.

This interest in muscle and its reflex control bore significant fruit in a collaborative study with Pi-Suñer, carried out in the laboratories of physiology of the Harvard Medical School, where Fulton went to complete the clinical years for the M.D. and to spend a fellowship year with Harvey Cushing. Studying the electrical activity of the quadriceps of the decerebrate cat, they noticed

that the irregular but continuous variations of the string were interrupted briefly after the much larger electrical excursion of the knee jerk—the so-called "silent period." Working as Fulton and Pi-Suñer did before the unit analysis of the stretch reflex was begun by Denny-Brown, they were unable to perceive the role that simple synchronization of unit discharge plays in the production of the silent period, nor did they consider the possibility, later developed by Lindsey, that otherwise active motoneurones were inhibited by the reflex effects of the tendon tap, but foresaw instead a third possibility—that during the knee-jerk the afferent stimulus to the stretch-reflex might disappear. They developed this argument as follows:

> That electrical responses should be absent during the knee-jerk, reappearing only after relaxation has begun, yields information concerning the mode of stimulation of the receptors for the knee-jerk and for the stretch reflex.
>
> In discussing the problem of the knee-jerk and stretch receptors, a distinction must first be made concerning the mechanical conditions prevailing (1), in a muscle in which tension is increased passively by an extending force applied to the tendon, and (2), in a muscle whose tension is increased through active contraction. If tension alone were the adequate stimulus for the afferent end-organs responsible for these "myotatic" reactions, then either mode of tension-increase would be effective in eliciting such a "myotatic" reflex. Were this true one would conceive of the muscle receptors subserving this reflex as arranged in series with tension-supporting elements (e.g., compare the end-organs in the tendon). But our observations indicate that the active contraction of a previously stretched muscle apparently removes the stimulus from the "stretch receptors," since during the course of such a contraction the action currents, which on good evidence one associates with reflexes set up by these receptors, are absent. Therefore, it is likely that the sensory organs in question are arranged, not in series, but in parallel with the executant units of the muscle. Reference to figures 2 and 3 will make clear the two possibilities of arrangement of sensory endings in muscle. If in figure 3 the middle unit, *s*, which is sensory, is stimulated by a stretching force and in this way there is set up a reflex contraction in muscle units *a* and *b*, it is evident that while *a* and *b* are active they will resist the stretching force applied at the tendon, and so operate to prevent further stimulation of *s*. When, however, *a* and *b* begin to relax, part of the burden of resisting the stretching force once more falls upon *s*, which again becomes stimulated and there occurs a repetition of the previous process. Now the knee-jerk and the stretch reflex appear to be explicable upon the basis of just such a mechanism as that postulated in figure 3, and it is difficult to account for them on the basis of any other mechanism.[1]

Recognizing that "the knee-jerk, according to this interpretation, is a brief manifestation of the same underlying response as that involved in the myotatic or stretch reflex," they continued:

When we come to correlate these observations with known morphological facts concerning the afferent endings in muscle we find certain highly suggestive relations. In the first place, muscle end-organs are divisible into two groups. *a*. Those which are disposed in series with the contractile active units; these are presumably tension recorders which provide for the central nervous system sensory data concerning tension alterations (active and passive). Of this group the most important are the Golgi tendon organs, which are found most abundantly in regions of the tendon and tendon aponeuroses immediately adjoining the flesh of the muscle. *b*. The second group are those disposed *in parallel* with the muscle fibres and correspond closely with the type of end-organ postulated in figure 3. These consist chiefly of the muscle spindles. We have accordingly a strong *a priori* ground for believing that the muscle spindles are in fact the end-organs which mediate such myotatic responses as the knee-jerk and stretch reflex.

Later studies of the afferent mechanisms by unit analysis entirely confirmed this analysis of the presumptive behavior of muscle spindle and Golgi tendon organ. Typically, a point was made to "acknowledge our indebtedness to Dr. Hallowell Davis for suggesting the use of the terms 'in series' and 'in parallel' in this exposition."

THE MOTOR CORTEX

During his clinical years at Harvard, Fulton came under the influence of Harvey Cushing with whom he spent an additional period after graduation as a Fellow. The influence was broad and lasting. It arose, no doubt, from their common interest in the history of medicine, and in particular their affection for Osler—the foreword to Cushing's Life of Osler had been written in Oxford in August of 1924. But Fulton was also an apt surgical pupil, and one of the greatest assets he brought to neurophysiology was a peerless surgical skill such as Cushing had applied to the human brain. Even more significant was the whole of the critical factors with which Cushing had surrounded his surgery: the meticulous localization of areas by stimulation, the clean-marginal, en-bloc resections with thorough histological study of specimens, detailed preoperative evaluation and persistent postoperative follow-ups, carefully recorded at the moment of study and never postponed until memory had dulled and unconscious supplementation had distorted, all painstakingly presented in ample, written protocols.

Most importantly, Cushing turned Fulton to thinking about the functioning of the cerebral cortex. To be sure, Sherrington had been one of the first to study the primate cerebral cortex, and Cushing had spent a month with Sherrington in his laboratory in Liverpool, helping with the craniotomies on an orang-utang and

a gorilla. Many years later, in his biography of Cushing, Fulton published one of Cushing's early letters from Sherrington's laboratory which showed much of Cushing's demand for accuracy, precision, and adequate protocols in experiments on the cerebral cortex.

> . . . As far as I can see [wrote Cushing in the first appraisal of Sherrington], the reason why he is so much quoted is not that he has done especially big things, but that his predecessors have done them all so poorly before. It's a great surprise all through physiological work to find that practically all observations are open to dispute or various interpretations.
>
> The simple point, for instance, concerning cortical stimulation which came up yesterday. It has been stated that only the crests of the convolutions can be stimulated. Letting out the fluid from the subarachnoid space and so emptying the sulci allows motor response to be obtained for entire precentral gyrus. Sherrington's observations during last two days show that the ascending parietal convolution is not irritable until one gets high up. This leaves a very small strip one convolution away i.e., the ascending frontal for arm, face &c. I asked S. if the convolutions were not irritable as they dipped down. He did not know but found they were way to bottom. This makes a surface ⅔ or more greater than the exposed surface. Furthermore the slicing off of surface as done by many and subsequent stimulations probably stimulated cells as well as tracts of corona radiata.
>
> The whole thing referable to experimental neurology much to my surprise is still in a most crude condition. The problems offered are immense. S. goes at them too fast. Few notes are taken during the observations, which is bad. S. says himself he has a bad memory—putters around his laboratory till after 7 in the evening trying to catch up on things and then is used up and doesn't begin till ten or eleven the next day. . . .[2]

A classical problem of human neurology has long been the enhancement of segmental reflexes that so often accompanies the paralysis of cortical and capsular lesions. Marshall Hall called attention to it in the early eighteen-hundreds and attributed it to a withdrawal of nervous energy from the local reflex areas by the ascending pathways in an early prototype of many later "long-circuiting" theories. Sechenov gave another direction to thinking in this area when he called attention to the inhibition of local reflex arcs when the corpora quadrigemina were stimulated chemically in the frog; indeed, by this experiment he returned the concept of inhibition to the central nervous system and made it a full partner to excitation in the intimate mechanisms of central nervous behavior. Hughlings Jackson, building up his hierarchy of nervous control of segmental reflexes by a succession of centers in the brain, foresaw that the lower centers could be welded into an operating whole by the excitatory actions of the higher centers only if these had available a means of suppressing or inhibiting the

natural propensities of the lower; naturally when a higher center was put out of action by disease or accident, the symptomatology of the patient, or experimental animal, would be of two kinds: deficiency symptoms reflecting the lack of excitation, and release phenomena derived from the loss of the usual suppressor or inhibitory action.

To all appearances, no preparation illustrated this principle or release of function more than Sherrington's decerebrate cat. The striking enhancement of the myotatic reflex, appearing promptly after prepontine decollation, and showing no signs of fatigue or diminution with the passage of time, was clearly not the result of stimulation of nerve tracts or cells by the trauma of the transection; Sherrington from the first interpreted it as a release phenomenon, and so also has been the verdict of history. Sherrington himself noted, however, that the rigidity that quickly appeared after hemisection of the brain-stem was homolateral, while the pyramidal tracts had not yet decussated; if the spinal terminations of these tracts were responsible for the release of segmental myotatic reflexes, the rigidity should have been contralateral. Other evidence would come to bear on the contribution of the pyramidal tracts to the release phenomena of cerebral damage—none more so than Bard and Rioch's careful study of chronic decorticate cats, where, certainly with a total destruction of all direct cortico-spinal fibers, only a very minimum release of myotatic reflexes could be documented.

It is probable, however, from the evidence in *Muscular Contraction and the Reflex Control of Movement,* that it was the striking dissimilarity in the spinal and decerebrate animals that first attracted Fulton to the problem of cerebral control of segmental activities. In a short historical review he pointed out that in the nineteenth century some authors came to regard pyramidal tracts as entirely inhibitory, while Sherrington believed that excitatory and inhibitory effects were commingled with the excitatory areas often sharply localized in the cortex and internal capsule. He then continued:

> When considered broadly, the outstanding feature of the central nervous system is the progressive phylogenetic dominance of the cerebrum. When this "organ" is removed, though coördinated locomotor activities are still possible, the power of "voluntary" inhibition of these activities is lost, and with this is lost also the power of "voluntary" excitation of them. It may be taken, therefore, as an adequate generalization that the full dominance of the highest levels of the brain is made possible through power to excite and to inhibit activity of lower centres. When the powers

of inhibition are abolished by removal of the higher centres, the general consequences are familiar to us in such release manifestations as spastic paralysis, etc. But, if we grant the principles of release of function and of the final common path as essential to the interpretation of the phenomena of reflex physiology, how are we to interpret the differences between the decerebrate and the spinal condition?

It is generally agreed that, as one sections the brain-stem at successive levels, the extent of functional release, as evidenced by the tonic coördination of the muscles, increases progressively until the level of section excludes the vestibular nuclei, when a condition of *hypo*tonicity supervenes. The occurrence of atonia in spinal animals might on casual reflection appear to be out of harmony with the conception of release phenomena. However, if we recall the variations of the most simple spinal reflex with which we are familiar, namely, the knee-jerk, as the brain stem is sectioned at successive levels, we obtain a more harmonious picture. Moreover, since the knee-jerk involves the neurones of the final common path, which are themselves directly subject to the influence of the higher centres of the nervous system, it serves as a delicate index of the condition of the final common path with reference to higher control.

An appended diagram serves to illustrate the important features of the knee-jerk in the intact animal, and in the Magnus, the decerebrate, and the spinal conditions, respectively. In the intact animal, it is often possible, by "voluntary" effort to produce complete inhibition of the knee-jerk. This is indicated schematically by tap stimulus not followed by a response. In the Magnus animal, on the other hand, or in an animal whose brain-stem is sectioned above the red nucleus, the knee-jerk is generally a single volley of impulses, *i.e.*, 40σ in duration, and the number of units responding for a given tap stimulus appears to be less in the Magnus preparation than in a red nucleus animal. In the vestibular animal, the knee-jerk tends to be a tetanus made up of two volleys. Finally, in the spinal animal, the knee-jerk is of much more ample duration, being a tetanus of 4 to 8 volleys. This would appear to demonstrate in an unequivocal manner that the anterior horn cells do become progressively released from inhibitory control as the brain-stem is sectioned at lower and lower levels.

Now, we have reason to believe that the knee-jerk is a fractional manifestation of the generalized myotatic reflex responsible for the maintenance of decerebrate rigidity. We must therefore ask ourselves this question: "How is it, if, in the spinal animal, the final common path is more released than in the decerebrate, rigidity exists in the former and not in the latter condition?" A satisfactory answer to this question has not yet been offered. . . .[3]

But while experiments of Bard and Rioch were still to be performed and the evaluation of the functions of the brain-stem reticular suppressor and facilitatory systems was even farther in the future, when Fulton in his earliest years at Yale turned his attention to the problem of spasticity after cortical lesions of the primates, it is clear that evidence was already collecting that denied to the pyramidal tract the main role in the production of the augmen-

tation of the stretch reflex manifested in the spasticity of cerebral and capsular lesions.

By 1932 experience with ablations of the motor area made it sufficiently clear that

> lesions sharply restricted to the motor area of various primates cause pareses which are invariably *flaccid* in character. The degree of flaccidity is more marked in higher primates, i.e., in anthropoids, than in monkeys, and is of greater duration. Motor power returns to a considerable extent after lesions restricted to the motor area, and is generally sufficient, within two weeks, to allow performance of progression movements, climbing, feeding, etc. The finer movements of the digits, however, are gravely impaired, especially in the anthropoids in which such acts as thumb-finger approximation may, after a lesion of the hand area, become permanently impossible.
>
> It is obvious that the flaccid pareses of cortical origin, associated as they are with rapid return of voluntary power, differ fundamentally from the motor deficit seen in cases of capsular hemiplegia in man, in which marked spasticity occurs associated with a much more profound and disabling loss of motor power. Since in our previous investigations we had been dealing entirely with flaccid paralyses of cortical origin we wished in continuing these studies to find whether spastic states similar to those seen in man after a capsular hemiplegia could be induced by lesions of the cortex, and also to ascertain whether the gradual return of power, following a lesion of the motor area, depends upon the integrity of some part of the cerebral cortex other than the motor area, or upon subcortical nuclei. We had at first considered investigating the postcentral convolution, but Leyton and Sherrington had already indicated that destruction of this area does not seriously affect voluntary power in chimpanzees in which the motor area had already been destroyed. We decided, therefore, to study the frontal regions, and in particular the so-called "premotor area." In this decision we were influenced by illuminating observations of Langworthy that extensor rigidity may be produced by lesions of the homologous area in cats, and by the important discovery of Richter and Hines that isolated destruction of the premotor area gives rise, in monkeys, to the symptom of involuntary forced grasping. We wish also to record our indebtedness to Dr. Paul Bucy, who in conversation in May 1932, pointed out that he had seen clinical cases which suggested that lesions of the premotor area give rise to grave postural disturbances. Finally we had ourselves occasionally observed transient spasticity following lesions of the motor area in animals in which we had encroached intentionally or unintentionally upon the premotor region.[4]

Fulton and Kennard summarized their observations on 10 monkeys, 6 baboons, 2 gibbons, and 3 chimpanzees as follows:

> 1. In monkeys, baboons, gibbons and chimpanzees lesions restricted to the motor areas give rise to a *flaccid* paralysis. Motor power returns gradually, though never completely, and essentially normal posture eventually becomes reestablished in all muscles except those of the digits. Spasticity and hyperextension are never seen.
>
> 2. Lesions restricted to the frontal areas, i.e., to the region anterior to the acruate sulci, cause no postural disturbance, but when bilateral, such

ablation gives rise to a definite syndrome characterized by great distractibility, restlessness, voracious appetite, and deterioration of previously learned skilled movements.

3. Unilateral lesions of the premotor area cause grave disturbances of the postural and motor mechanism in the contralateral extremities, i.e., forced grasping, impaired motor power and spasticity. In the course of several weeks, however, these symptoms may disappear completely, but they return when either the opposite premotor area or the ipsilateral motor area is removed.

4. Spasticity and forced grasping become permanent in baboons and monkeys when the motor and premotor areas are removed from both sides.

5. After ablation of the motor area for the arm or leg in the chimpanzee, extirpation of the premotor region (e.g., area $6a\chi$) causes forced grasping in both opposite extremities, and marked spasticity with virtually complete loss, for a time, of voluntary power in the monoplegic extremity. In the chimpanzee the motor and postural disturbances following such combined lesions closely simulate the corresponding disturbance seen in man after hemiplegia from a capsular lesion. This similarity is much more evident in chimpanzees than in monkeys and baboons.

6. Ablation of the chimpanzee's premotor area causes exaggeration of deep reflexes, and, if the motor area has been previously destroyed, a marked accentuation occurs of the signs of Babinski and Rossolimo and the sign of fanning of the toes also appears.[4]

A natural extrapolation then followed from what was recognized as a

. . . meager literature relating to the *anatomical connections* of the premotor area. The region clearly gives rise to a small bundle of fibers that pass through the anterior end of the internal capsule (Flechsig; Ferrier and Turner), and the studies of Déjerine, and of von Monakow tend to show that some at least of the fibers pass downward into the mesial segment of the crus to form the fronto-pontine tract; while the work of Marinesco and Minkowski indicates that some prerolandic fibers pass to the dorsal part of the head of the caudate nucleus. More recently Schuster and Casper have traced fibers from the premotor area into the capsule, and also a large group which cross through the corpus callosum to the opposite side. Finally some fibers from this area appear to go both to the substantia nigra and to the red nucleus (Poljak). Painstaking anatomical studies of the connections of the premotor area are urgently needed. It is clear, however, that this region of the cortex sends communications to the chief extrapyramidal motor projection systems, in addition to its well recognized connections with the true motor area."[4]

From these considerations the final conclusions were:

1. The chief cortical representation of the extrapyramidal motor projection systems lies in the premotor area. 2. This region is concerned with the integration of complex volitional movements and postural adjustments. 3. It is probable that spasticity following a capsular hemiplegia in man is brought about by interruption of the fibers from the premotor area which pass in the anterior end of the internal capsule in addition to involving the fibers of the pyramidal tract. . . .[4]

This distinction between the "motor" and "premotor" areas, which were equated to area 4 and area 6 respectively, was brought into sharper belief in a paper by Bucy on the stimulation of area 6 in two rhesus monkeys, a baboon, two chimpanzees and a gibbon, from which it was concluded that: 1. Stimulation of area 6 of the primate brain gives rise to: (a) Sustained contractions of moderately small groups of muscles in the contralateral extremities. These responses are mediated by fibers which pass to the motor cortex. (b) Complex progressive and rhythmic movements in the contralateral extremities, which are effected at least in part by fibers which are direct projections of area 6, independent of the motor cortex. (c) Responses in the ipsilateral extremities, principally the lower ones, and the tail. 2. The threshold of area 6 is higher than that of area 4, becoming increasingly greater for each of the four types of response in the order listed, except for c and d which are essentially the same. 3. The responses of area 6 are much more susceptible to anesthetic drugs, especially the barbituates, than the responses of area 4. 4. The movements, elicited from the premotor area are much more prone to pass into epileptiform afterdischarge than those evoked from the motor cortex.

Shortly thereafter Fulton, writing on "Forced grasping and groping in relation to the syndrome of the premotor area," defined the "premotor syndrome" as a complex of "(1) impairment of skilled movements without gross loss of motor power, (2) spasticity and increase of tendon reflexes, (3) forced grasping, and (4) vasomotor disturbances in the affected extremity."[5]

These views, and the findings upon which they were based, were not universally accepted. Walshe in particular objected to the partition of the excitable cortex into motor and premotor divisions, and to the suggestion that the two divisions had separable functions at the cord level and operated by different projection pathways, which evoked "A Note on the Definition of the 'Motor' and 'Premotor' Areas."[6] In 1937 Fulton took the opportunity of a lecture at Toronto to review his position and the work that it had stimulated which he summarized as follows:

> 1. Spasticity is a state of release from cortical control of subcortical centers of the brain; it is characterized by increased resistance to passive manipulation, especially in the antigravity muscles (extensors of the lower limb and flexors of the upper), and is associated with increased tendon and stretch reflexes, clonus, the clasp-knife phenomenon, and so forth. It is thus to be distinguished from basal ganglia rigidity in which the *quality* of resistance is different and in which these specific reflex changes are not conspicuous.

2. In monkeys and the higher apes the motor projections whose interruption causes spasticity arise in the frontal lobes. Regional ablation of various parts of the frontal lobes in macaques indicates that spasticity occurs in its purest form after removal of a strip of transitional cortex lying between the motor and premotor areas (Hines). When areas 4 and 6 are removed in addition to the strip region, an enduring element of rigidity is introduced, causing the tendon reflexes to be masked, and the resistance to passive movement to be greatly augmented both in the proximal and the distal joints; in these circumstances the resistance is no longer restricted to antigravity muscles.

3. Isolated section of the pyramidal tracts in the medulla of a macaque causes a simple flaccid paresis without trace of spasticity in any joint at any time following the lesion (Tower).

4. Ablation of area 4 posterior to the strip region causes a similar flaccid paresis at proximal joints associated with a transient phase of digital spasticity (Denny-Brown and Botterell).

5. Ablation of area 6 anterior to the strip region causes forced grasping and a state of soft plastic rigidity equal in quantity from beginning to end of passive movement, which tends to affect flexors and extensors to an approximately equal extent. This resistance has been inaccurately referred to in the past as "spasticity."[7]

The conclusions that Fulton drew from these considerations were, that

(1) Spasticity is unrelated to disturbances of the pyramidal pathways. (2) Spasticity is a manifestation of release from extrapyramidal cortical projections. (3) Pure spasticity in antigravity muscles results from interruption of the extrapyramidal projections situated in the posterior part of area 6 and area 4. (4) When all the extrapyramidal projections of the frontal lobe are destroyed, a much more profound and enduring rigidity occurs which tends to mask spasticity; in these circumstances muscular rigidity becomes generalized, but depends for its precise local distribution upon the position of the body in space (operation of neck, labyrinthine and body-righting mechanisms.[7]

Ruch has well expressed the judgment of the past twenty years on these matters:

Investigation of the motor systems based on regional cortical ablations, principally by Fulton and Kennard, and on section of the medullary pyramids by Tower and by Hines have profoundly altered the interpretation of such common clinical disorders as hemiplegia. Neurologists and neuropathologists were handicapped in learning the neuroanatomic basis of the signs making up hemiplegia because capsular lesions simultaneously and inevitably damage both the pyramidal and the COEP systems. In fact, the same is true of all other naturally occurring damage to the cortico-spinal neurons in the cortex, brain stem or spinal cord. That all of the signs of hemiplegia should have been ascribed to disruption of the pyramidal tract is an understandable error, but neurophysiologic analysis has now shown that many classic signs of pyramidal tract damage are in fact caused by damage to the extrapyramidal system.[8]

While therefore the main outline of Fulton's concept stands firm, there remains the problem of correlating his findings of a dual frontal motor representation with more recent revelations of a supplemental motor area, and in particular with Woolsey's outline of a single somatatopically organized primary motor area in which the acral portions are anchored at the floor of the Sylvian fissure with the axial portions extending anteriorly into what would be area 6. A preponderantly pyramidal representation of the acral and an extrapyramidal representation of axial musculature might well account for the differences Fulton noticed upon stimulation and ablation of area 4 and area 6, or he may well have included the supplementary motor area as well, for "he was skillful in working along the great dural sinus which made the completeness of a lesion along the midline an added challenge [personal communication from T. C. Ruch]." Certainly, too few attempts have been made to repeat and extend these studies.

THE NATURE OF CORTICAL CONTROL OF MUSCULAR CONTRACTION

More than anyone, it has been Sherrington who has been responsible for the modern theory of cortical localization by his repeated demonstrations of the response to cortical stimulation and by publication of maps showing punctate localization of body musculature in the precentral gyrus. Another, opposite, view has seen in the instability of cortical points and the recovery from small cortical lesions a different form of cortical control through widespread overlapping of representation of muscle groups, invoking Sherrington's dictum that "the brain thinks in terms of movements not muscles." Sherrington himself can hardly serve as an advocate of this opposing view, for he has stated quite clearly:

> . . . It appears at first sight surprising that a motor nervous organ relatively so high as is the cerebral cortex in the nervous hierarchy, where the power to deal with large integrated complexes of the motor machinery might be expected, exhibits on actual examination a representation, still more or less discrete, of relatively small and "partial" movements. And in the motor cortex this discrete "representation" of small local items of movement, each highly co-ordinated with others yet separably elicitable, instead of becoming less evident with ascent to the higher types of hemisphere, becomes more so. Thus, it is more evident in cat and dog than in rabbit, more evident in the Macaque than in cat or dog, in baboon than in Macaque, in gibbon than in baboon, and in the chimpanzee, orang, and gorilla than in gibbon. It would seem that in order to preserve the possibility of being interchangeably compounded in a variety of ways successive or simultaneous, these movements must lie, as more or less discrete and separable elements, within the grasp of the organ which has the varied com-

pounding of them. To draw an analogy merely illustrative, the synthesis of the proteins of the body requires that certain metabolic organs must have, lying at their hand, the numerous amino-acid constituents of proteins; for that purpose the food proteins, split up into constituent chemical sub-groups, more or less freed one from another, are presented to the synthetic organs for varied re-grouping in the re-synthesis which follows. . . .[9]

In 1946 Chang, Ruch, and Ward reported on a careful myographic study by simultaneous recording of eight muscles arrayed around the ankle joint in rhesus monkeys, stimulated to contract by unipolar faradization of area 4. They were thus able to confirm completely that in the

". . . precentral gyrus of the macaque there is a detailed pattern of representation of the skeletal muscular system and that the basic plan of this pattern can be analyzed in terms of muscles. Thus, although there is overlapping of cortical fields for various muscles and muscle groups, comparable to the overlapping of cortical fields for peripheral cutaneous areas, individual muscles are represented maximally in specific parts of the precentral gyrus. . . ."

For each of the muscles acting over the ankle that responded to cortical stimulation (the extensors) there exists in the leg area of the cerebral cortex a focus of representation from which that muscle can be activated as an "isolated" or "solitary" response, or can be activated more strongly or more promptly than from adjacent regions. Only one such focus for each muscle is found and the focus of representation of two muscles in no case falls at exactly the same locus, even for two closely allied muscles such as tibialis anticus and abductor hallucis longus. Surrounding the focus or concentration of representation and completing the field is a fringe from which the responses are submaximal and slower in onset than from the focus itself. The fringes of the excitation fields for different muscles overlap in varying degrees. Finally there are intervening strips and areas which are consistently "silent" with respect to muscles under observation with stimuli which produce nearly maximal responses accompanied by epileptic after-discharges when applied to neighboring cortical points. It is assumed that the topographical representation of muscles finds its greatest expression in the layer of large pyramidal cells.

A cortical representation of muscles does not necessarily imply the existence of a mosaic pattern of strictly isolated subareas of the motor cortex, each dedicated to a single muscle. However, the procedure of cortical stimulation is one calculated to minimize the sharpness of muscle localization. If absolute boundaries existed, they would be obscured or blurred by several factors inherent in cortical stimulation experiments. Each Betz cell is potentially connected with many ventral horn cells through the internuncial neurons of the spinal cord. Also to be expected is an involvement of a wide range of musculature through activation of extrapyramidal fiber systems from the motor area. Betz cells are stimulated by current passing through, and hence stimulating, a dense pile of transcortical fibers. Therefore the excitation is further spread by profuse transcortical connections to adjacent cortical points, which are only a few millimeters removed. Finally, the physical spread of current, though not of threshold value, may facilitate neighboring foci, making them more sus-

ceptible to transcortical excitation. For these reasons it is difficult to establish and easy to underestimate the degree to which the Betz cells for a given muscle are aggregated and segregated. The present experiments suggest that the representation of muscles stands midway between a strict mosaic pattern and diffuse representation. The maps of muscle foci suggest that the Betz cells for a particular muscle are distributed over a contiguous area of the cortex with the highest cell concentration located at a particular focus within that area, and that the farther from that focus, the more sparsely scattered are the Betz cells devoted to that muscle. Thus, a considerable but undeterminable overlapping of the fringes of each field of Betz cells is envisaged. . . .[10]

It should be remembered that not all muscles were equally accessible to cortical stimulation. The anatomical flexors were much less available than the extensors, and of these latter, those of the toe were more responsive than those of the ankle. Again it would appear that terminal more than axial muscles are so controllable, and that the cortex can regulate movement in either of two ways: by "releasing" motion that is largely mediated in the lower center of the brain or even the spinal cord, such as walking, running, etc., or it can synthesize from the elements available to it motions that are almost if not completely integrated at the cortical level itself.

AUTONOMIC REPRESENTATION IN THE CEREBRAL CORTEX

The autonomic nervous system and its relation to the hypothalamus was one of Fulton's favorite subjects; he had as a fellow at Harvard collaborated with Percival Bailey in reporting on tumors in the region of the third ventricle, pointing out their relationship to pathological sleep, and the first paper he published from the Yale Laboratory was on the physiological basis of the surgery of the sympathetic nervous system.[11] Royle in Australia had proposed sympathetic ramisection for the control of spasticity in spastic paralysis, based on a hypothesis still current at that time that the "tonus" of skeletal muscle resulted from a different kind of contractility than that responsible for voluntary movement, and controlled by the sympathetic and not the somatic nervous system. Fulton reviewed the work of Liddell and Sherrington and of Denny-Brown on the stretch or myotatic reflex as the basis of the postural "tone" of skeletal muscle and concluded

that the sympathetic is not essential for the maintenance of normal reflex posture or the exaggerated postures of spastic paralysis, and that any influence which it may appear to exert is purely secondary and due to an obscure effect upon the well known somatic reflex mechanism. Whether this secondary influence is of sufficient magnitude to justify surgical

ramisection in cases of spastic paralysis is still an open question. Though it is difficult to find clear-cut physiological justification for such a procedure and though many case reports are unconvincing, one cannot overlook certain of the evidence of reliable clinical observers who claim that ramisection has caused in certain spastic cases permanent and beneficial diminution in rigidity.[11]

Royle was himself in the audience, and it is typical of Fulton that his criticisms were never completely destructive and that he always allowed his opponents a route of escape.

Very soon after the Yale Laboratory was open, primates with cerebral lesions began to accumulate in significant numbers, and it was observed that vasomotor reactions were altered on the side opposite the lesion; the limb was cooler, and the vasodilator response to warmth was slow and sluggish. At the same time Kennard reported a number of parasympathetic manifestations associated with the premotor cortex: (i) stimulation of the premotor cortex evoked slowing of the heart and irregularity of the heart beat, and an increase in gastrointestinal motility, while (ii) ablation of the premotor cortex was at times followed by intestinal stasis and intussusception.[12] These latter phenomena were later reported in detail by Watts and Fulton,[13] and in 1934 Fulton wrote on "autonomic representation in the cerebral cortex" in a Beaumont Foundation Lecture:

> The hypothalamic and medullary centers concerned in regulating visceral activities are held in check by centers lying rostrally in the forebrain. These higher centers, therefore, must also play a part in the regulation of visceral functions. The extent to which the cerebral cortex is involved has been briefly considered.
>
> Bilateral extirpation of the premotor cortical areas of monkeys leads to great increase in peristaltic movements of the entire gut, which in certain cases has caused spontaneous intussusception with obstruction. Great augmentation in peristaltic movements may also be induced by faradic stimulation of the frontal lobes, and this disappears when the vagi are sectioned. Evidence is given indicating that both excitatory and inhibitory representation of the gut musculature is present in the frontal lobes.
>
> Stimulation of the frontal region causes widespread vasodilatation, with fall in blood pressure. Isolated removal of the premotor area of monkeys and chimpanzees causes increased sweating on the opposite side of the body with a fall in temperature which is probably independent of sudorific activity. If an animal with a premotor lesion is placed in a warm atmosphere, the normal extremities exhibit immediate reflex vasodilatation whereas the extremities opposite the lesion fail to do so. This indicates impairment of the reflex vasodilator mechanism.
>
> Salivation has been produced in monkeys by stimulation of area 6b and it occurs in man as a result of pathological lesions situated in this region.

The well recognized representation of the pupils, bladder and vaginal and anal musculature in the cerebral cortex is touched upon.[14]

The implications of these findings were analyzed in considerable detail within the next few years, in particular by E. C. Hoff and Green,[15,16] who made it quite clear that the cardiovascular changes elicited by stimulation of the cerebral cortex were primary and not secondary to changes in somatic musculature, etc., nor to spread of current to underlying structures. Although in most instances somatomotor and vasomotor points overlapped, this was not invariable, and pilomotor points were found on the cingulate gyrus. These appeared to the authors to

. . . clearly demonstrate the existence of two distinct cortical mechanisms. The first of these exerts control over somatic movement as shown by the normal motor response to stimulation and the exaggerated activity of the epileptiform type of motor after response. The second influences vasomotor and other visceral activities, and is demonstrated by the occurrence of heart rate and blood pressure changes during cortical stimulation in the absence of any somatic activity. Since the alterations in the vasomotor mechanism which would reasonably be expected to occur under cortical direction would be those concerned in adjusting the responses of the vascular system to the activities of the somatic, it is not surprising that the distribution of the representation of the vasomotor system so closely overlaps that of the somatic. In view of this close anatomical association it is quite possible that in the normally functioning individual afferent impulses which activate the somatic efferent will also affect the visceral efferent mechanism.

The abnormal visceral activity which precedes and accompanies an epileptic attack has been described by Frisch and furthermore according to Watts and Frazier such phenomena evidently occur in the absence of skeletal motor manifestations. Thus the cortical lesion responsible for the somatic manifestations of the clinical epileptic seizure may also initiate activity within the overlapping cortical visceral mechanism, and so account for the vegetative disturbances which precede and accompany the attack.[15]

Under the impetus of World War II these studies were pushed vigorously. Trueta had, for instance, noticed a diversion of blood flow away from the glomeruli of the kidney during traumatic shock, and there was evidence that this was a nervous mechanism, perhaps of reflex origin. While subsequent studies have failed to support the concept of an active shunting mechanism of this type in the kidney, the concept of a nervous intervention in the regulation of the cardiovascular system was powerfully stimulated, and with a new team of investigators Fulton pursued the concept of double cortical mechanisms in control of somatic and autonomic divisions of the nervous system, overlapping extensively, as in the control of vasomotor activity and respiration from both cortical

zones. It was quickly apparent from work in the Laboratory as well as elsewhere that the orbitoinsular areas, the cingulate gyrus, and indeed the whole of the limbic system constituted the special realm of the "visceral" cortex.

The Frontal Lobes and Behavior

Fulton's revival of interest in the neurophysiology of the primates, and his introduction of the refinements of human brain surgery to physiological surgery came much at the same time that Corner, Hartman, and van Wagenen began to study primate endocrinology, and Yerkes, its psychology. Thus it became possible to add to the new physiological and surgical approach adequate techniques for the objective analysis of psychological factors. Monkeys and chimpanzees could "be trained in complex problems involving skilled maneuvers, successive acts occurring in definite sequence, and in various forms of delayed reaction which taken together served to test both motor dexterity and the retention and organization of recent sensory experience,"[17] and after appropriate cortical ablation could be re-tested. Carlyle Jacobsen brought these skills to the Laboratory of Physiology in its early years, and it quickly became apparent that removal of the motor area included in area 4 produced a deficit that was almost exclusively motor; the animal rapidly readjusted to the hemiplegic member and used the functional limb and hand for the manipulations previously executed by the affected limb. Remaining gross movements of shoulder or mouth and head were often substituted for deficient fine movements of hand and fingers. Despite difficulty in execution of these movements, there was no indication that the habit was itself impaired. By contrast, premotor lesions, which resulted in minimal motor deficits, were followed by considerable disorganization of the learned pattern, which required postoperative relearning.

Bilateral lesions placed even more anteriorly in the frontal lobes were, as Fulton and Jacobsen wrote,

> . . . of a different character, perhaps more truly "intellectual." Yet it is a disturbance basically related to the behavior deficits associated with lesions of the premotor areas. Just as the premotor areas mediated patterning of motor responses, more complex than that executed by the motor areas, the frontal association areas add a further elaboration over and above that of the motor and premotor areas. It is essentially a temporal patterning of behavior which is evident in the continuity of response, an outstanding characteristic of the behavior of the higher animals, and especially of man.

(a) Instrumentation test. The nature of the deficit will be clear from a consideration of several experiments with the chimpanzee. The chimpanzee exhibits no little ability in manipulating its environment either through emotional outbursts or by hard work. The first series of experimental tests utilized the subject's capacities for instrumentation. The chimpanzee was confined within the cage indicated in the diagram; on the platform at the end of the cage a piece of food was placed slightly beyond the animal's unaided reach, and a stick of suitable length made available. Solution of the problem required the animal to extend its reach by using the stick to draw in the food. This task was complicated by arranging from two to five sticks in the platform so that the nearest stick could be used to draw in a slightly longer stick, which in turn could be used to secure the third stick, and so on until the last stick, long enough to reach the food, was obtained. It is important to note that, although complexity was increased, all essential features of the problem were grouped on a single platform, and were within the subject's visual field while it worked at the problem. Neither unilateral nor bilateral extirpation of the frontal association areas significantly alters the solution of these problems. . . .

(b) Delayed reaction: In the test of recent memory the animal was given an opportunity to observe the experimenter conceal a piece of food under one of two cups. An opaque screen was then lowered between the animal and the test objects, and after an interval ranging from a few seconds to several minutes, the animal was permitted to choose between the two cups. Since there was nothing in the external appearance of the two cups to give cues requisite to a correct choice, it was necessary for the subject to remember under which cup the food had been concealed.

In the first series of tests, the two test objects were separated about 75 cm., and were presented before a variegated background. Under these conditions, the animals remembered from 3 to 5 minutes where the food had been hidden. Unilateral extirpation had no effect on the performance of this test; but extirpation of the second prefrontal area in each instance caused complete inability to respond even after delays as short as five seconds.

In the second series of tests, the two cups were moved closer together, separated about 25 cm. and were presented before a uniform grey background. A high per cent of correct responses was scored after delays up to one minute although the performance was no better than chance when the delays exceeded that value. Extirpation of one frontal area did not modify performance. Ablation of the second frontal area, however, rendered the subject incapable of responding after delays of two seconds—the minimal interval that could be tested with this set-up.

One subject failed this test both before and after operation. This failure yields most instructive data. In the normal phase, this animal was extremely eager to work, and apparently highly motivated; but also this subject was highly emotional and greatly upset whenever she made an error and violent temper tantrums after a mistake were not infrequent occurrences. She observed closely the loading of the cup with the food, oftentimes whimpering softly as the cup was placed over the food. If the experimenter lowered or started to lower the opaque door to exclude the animal's view of the cups, she immediately flew into a temper tantrum, rolled on the floor, defecated and urinated. After a few such reactions during the training period the animal would make no further responses to the test situation, although she responded eagerly if tested on different problems. Training

on this situation was continued daily for three weeks. At the beginning, the animal had been eager to come to the experiment room, and when released from the living quarters ran to the transfer cage, opened the door and crawled in. By the end of this period, it was necessary to drag the animal from the living cage to the transfer cage, and in turn force it into the experimental cage. It was as complete an "experimental neurosis" as those obtained by Pavlov's conditioned reflex procedures.

The animal was gradually reaccustomed to the experimental set-up by feeding and play in the apparatus, and a second series of observations made, this time with only the glass door between the animal and the cups. Under these conditions, the animal chose correctly after delays shorter than thirty seconds, but failed at delays above this point.

The same test procedure was repeated after the extirpation of one frontal area. Once more, a profound experimental neurosis was established through lowering the opaque screen during the delay period, and again broken up through elimination of the particular problem and generous feeding and play in the experimental room. Observations were then made with only the glass screen, and as in the normal phase the animal failed when the delays exceeded thirty seconds.

When this animal was rendered a bilateral frontal preparation, a profound change occurred. The chimpanzee offered its usual friendly greeting, and eagerly ran from its living quarters to the transfer cage, and in turn went promptly to the experimental cage. The usual procedure of baiting the cup and lowering the opaque screen was followed. The chimpanzee did not, however, show any excitement, but rather quietly sat before the door or walked around the cage. Given an opportunity to choose between the cups it did so with its customary eagerness and alacrity. However, if the animal made a mistake, it showed no evidence of emotional disturbance but quietly awaited the loading of the cups for the next trial. The opaque door was again lowered but without untoward effects, and if the animal failed again, it merely continued to play quietly or to pick over its fur. Thus while the animal repeatedly failed and made far greater number of errors than it had previously, it was impossible to evoke even a suggestion of an experimental neurosis.[17]

It is of course well known that these studies were to Egas Moniz the immediate occasion for undertaking the procedure of prefrontal lobotomy. Whatever may be the current or ultimate judgment of the value of the operation as a clinical procedure, there is little doubt that the revival of interest in the association areas, and in the limbic system as the neurological substratum of behavior, was strongly supported. The work of Bucy, Livingston, MacLean, Pribram, Kaada, Brobeck, Delgado, and others of the Yale group indicates something of what has grown out of the early experiments of Fulton and Jacobsen.

I have often thought that Fulton resembled John Hunter in his breadth of vision, his driving energy, his all-encompassing curiosity, his love of surgical virtuosity and dissection, his feeling for comparative physiology, his broad humanity, and his resolute

denial that even serious illness could keep him from his work. Something of the Hunterian scope is seen in a simple listing of some of the titles of his other papers: Effects on gastric secretion of frontal lobe stimulation; Interrelation between anterior lobe of cerebellum and the motor area; Aviation medicine; Altitude decompression sickness; Ablation of area 13 in primates; Nature and treatment of blast injuries; Histopathology of the central nervous system after exposure to high altitude; Hypoglycemia and other conditions associated with central anoxia; Effects of high altitudes studied in decompression chamber; The housing, care and surgical handling of laboratory primates; Anoxia, pH shifts and central nervous function; Age and reorganization of central nervous system; Estrous cycle in Tarsiers; Functional interrelations of cerebral cortex with basal ganglia and cerebellum; Experimental tremor and chorea in monkey and chimpanzee; Corticostriatal interrelations in monkeys and chimpanzee; Endocrine weights of primates; Levels of autonomic function with particular reference to the cerebral cortex; Interrelation of cerebrum and cerebellum; The relation of the motor area of primates to spinal shock; Functional localization in the cerebellum; The effects of lesions of the hypothalamus upon the gastrointestinal tract and heart in monkeys; The uncrossed lateral pyramidal tract in higher primates; Functional recovery in ocular muscles of chimpanzee after section of oculomotor nerve.

Like Hunter, too, Fulton was preëminently a person who served as a bridge between the specialties of medicine, in particular between neurophysiology on the one hand and clinical neurology and neurosurgery on the other. Stewart Wolf has called attention to the need for this kind of interdisciplinary communication, writing that "Neither have the findings of the neurophysiologists been incorporated into the thinking of most clinical investigators whose special fields embrace the organ in question, such as the cardiovascular system, the lungs, the kidneys, and so forth. The language of the neurophysiologists, the psychiatrists and the clinical investigator are so disparate as to make it very difficult for them to understand one another."[18] The Laboratory of Physiology at Yale under Fulton was one of the rare places where full and free communication among the specialists was a reality, and this global concept of medicine has been remembered and practised wherever his many pupils have gone and whatever their specialities have been.

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John Fulton's Historical and Bibliographical Work

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READING John Fulton's historical writings piecemeal as they appeared through more than thirty years, I was continually astonished at the versatility which produced biographies, bibliographies, studies of scientific texts, histories of discovery in one field or another. Who and what would attract him next? All this was not to be ranked as a mere avocation, but marked a second career as historian and scholar parallel to his equally productive and documented career as a scientist.

Looking back, however, over the historical writings as a whole, while still amazed at their range and detail, I now see a remarkable unity of purpose in their sequence and in their relation to his technical and medical writings. Physiological discovery, in particular the physiology of the nervous system, fascinated him in whatever age it appeared. He pursued knowledge of it with equal enthusiasm in the laboratory, at the conference, and in the library, while his gift of inspiring his fellow workers, and of making friends with men and women of differing backgrounds, enabled him to enjoy the amplest co-operation from his colleagues and pupils and to draw full inspiration from his own teachers and from those yet older friends known only through books.

Books and men: a real love of both prompted all his historical explorations. As a dedicated "educator" he needed to make widely known whatever he knew; as a "humanist" he was ever urgent to discover the human being behind the advance in science, and to show his contemporaries that the fellowship of knowledge extends not only right across the world but back and forth on the stream of time.

Fulton's major works in biography, history, and bibliography are so well known and so permanent a contribution to literature that it would be impertinent to submit them here to elaborate dissection. The range of his shorter studies in these fields, which are less well known as a whole, can be gauged from the complete Bibliography[1] which appears elsewhere in this issue. Instead, there-

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1 I quote Fulton's writings by number to avoid duplicating the detail in the Bibliography. See below, pp. 51-70.

fore, of surveying his production item by item, I have tried through a choice of representative writings to track the movement of his thought, noticing the connection of different studies and the recurrence of favorite themes. I have quoted his obiter dicta to show his motives and the lessons which he drew from the past.

A theme that recurs continually is the evocation of personality from the anonymity of scientific ideas. We find it as early as 1929 in sketches of individual discoverers (56, 58, 60, 61, 63), and more extended in such studies as "Bacon and the Royal Society" (103) and "Early medical humanists" (107). It was elaborated most successfully in his first historical book, *Selected Readings in the History of Physiology* (91), and it was still the natural expression of his approach at the end in such papers as "Paolo Mascagni and the lymphatics" (489), "Discovery of the capillaries—Malpighi, Leeuwenhoek, and Hales" (498), or "Ramón y Cajal, Sherrington, and the neurone doctrine" (514).

His first scientific book, *Muscular Contraction* (31), included a long historical chapter, some fifty pages, much more thorough than such surveys of preceding work usually are. Its use of original bibliographical evidence both in text and illustrations is characteristic of Fulton's approach, and it shows how aware he was of the influence of personality. Much of his subsequent historical work elaborated themes which he had sketched in this chapter. He dealt first with the early period before the middle of the eighteenth century, remarking that the study of this period "shows in an unusual way the continuity of ideas in a relatively limited field of human thought." The three pages devoted to the eighteenth-century physician Robert Whytt are the most original part of his survey, for he had not yet completed his work on the seventeenth-century physiologists—John Mayow for instance is praised as "an original mind endowed with all the essentials of genius," a judgment which Fulton considerably modified on closer acquaintance. Next he dealt with Galvani, the pioneer of electrophysiology, another "hero" to whom he frequently returned; then he discussed the rise of thermodynamics and chemistry in their physiological applications, from Helmholtz to modern times, and it becomes clear from his subsequent writings that it was the physical and chemical aspects of physiology which always most intrigued him. Finally he described the most modern period, showing how completely at home he was in contemporary scientific literature.

Already in the late twenties—his own and the century's—he was "throwing off" frequent short sketches on topics which had drawn his notice, recording his discovery of several pioneers in his own fields of interest such as Robert W. Smith, James Black, and Edward Selleck Hare, and usually reprinting their neglected texts (e.g., 58, 61, 63). He also wrote brief memoirs of senior physiologists who had lately died, (J. N. Langley, E. H. Starling, Rudolph Magnus, William Einthoven), a duty usually left to their surviving contemporaries, showing that, young as he was, he could well evaluate both their work and their personalities (e.g., 28, 33, 38, 39).

It was at this time and at Oxford, as he recalled long afterwards (346),

> while attempting to help W. W. Francis with the section on anaesthesia in the Osler Catalogue, I became interested in the anaesthesia literature. Later in 1926 Dr. Allen Johnson, editor of the *Dictionary of American Biography*, invited me (on bad advice from his son) to prepare the lives of the men concerned in the introduction of surgical anaesthesia: these were submitted in 1929.

Buried in that great work, Fulton's masterly essays are little known to his admirers. These lives of the anaesthesia pioneers, where he broke new ground in weighing the literary evidence, thoroughly deserved the pawky compliment of his editor: "Where did you do them—in Boston?" This research bore fruit many years later in the admirable little volume compiled with Madeline Stanton, *The Centennial of Surgical Anaesthesia* (342), where the whole early literature was surveyed in careful detail. There were also several special essays, such as "The Morton and Warren tracts on ether (Letheon)" (327), which is a neat piece of pure bibliography, and "The vision and daring of youth" (346), a typically humane study of the pioneers, with an introduction on the "prehistory" of the subject which displays Fulton's profoundly sympathetic knowledge of the Renaissance and the seventeenth century. Anaesthesia here links up with his life-long interest in Robert Boyle, and with certain aspects of the studies in the history of aviation medicine, which became a major interest during World War II.

The early studies of individual scientists and discoveries were summarized and surpassed by Fulton's first wholly historical book, *Selected Readings in the History of Physiology* (91), published in 1930. Such anthologies of "elegant extracts" have a long history;

one recalls in the medical field, for instance, C.N.B. Camac's *Epoch-making Contributions to Medicine,* 1909; but Fulton's book can more fairly be compared to E. T. Withington's *Medical History from the earliest Times,* 1894. Each author was barely thirty when he wrote, and each showed an astonishing mastery of wide reading; Fulton also showed himself very conscious of bibliographical precision, while the summary introductions to the sections of his book are little masterpieces of concise instruction. He was careful "not to repeat the figures and portraits so often seen" and was fully justified in including extracts from several unfamiliar "pioneers," such as Charles Blagden, Wilson Philip, and Alexander Walker. Withington was still living at Oxford at this time, and his work must have been known to Fulton through Osler's and Sherrington's praise of it.

Osler had died before Fulton came to Oxford but he claimed to have "met" him through Lady Osler and through his library; Osler's spirit touched him too through many who had known him well, not least through Dr. Cushing. Thirty years later Fulton put on record in a series of delightful papers his acknowledgment of his debt to Osler (390, 396, 407), to Lady Osler (391), and to W. W. Francis, their cousin and librarian (484, 511). The paper on "Grace Revere Osler: her influence on men of medicine" is particularly revealing for its characteristically modest account of Fulton's own introduction to her friendship. I have already mentioned his work on Osler's anaesthesia collection, and elsewhere (390) he attributed to a chance find among Osler's papers his keen interest in the Warrington circle of Joseph Priestley.

Selected Readings appeared immediately after Fulton's election to the Sterling Chair of Physiology at Yale, and he quickly followed it with a second survey of the history of his subject, the pocket volume *Physiology* (102) in Dr. E. B. Krumbhaar's *Clio medica* series. In the preface to this primer he stated very clearly his constant view of medical history:

> It is possible merely to record the development of ideas without reference to the lives of the men who created them. Another mode less erudite but possibly more appealing is to weave into the story significant details of the lives of those who have been contributors. It is often the case that the way a man lived and worked is a greater stimulus to those of a later age than what he did. Beaumont's studies for example are robbed of much of their significance if one is unaware of the extraordinary circumstances in which he laboured.

So short a book on so large a subject was necessarily something of a catalogue of names, but Fulton sensibly limited his story to a few defined aspects of human physiology. He gave, however, a most original chapter on "the rise of the teaching laboratories," which records the personal influence of certain great master-physiologists.

Naturally he was accustomed from his own scientific work to deal with ideas and hypotheses and was well aware of their seminal importance in the growth of knowledge, but he was firmly grounded in the Anglo-American practical tradition of biographical history and his writings show little taste for generalized concepts or historical philosophizing. A few titles among his papers might suggest the contrary (e.g., "A prolegomenon to the sciences" [394], "The impact of science on American history" [420], "Historical reflections on the background of neurophysiology" [506]), but even these will be found to have a solid biographical content.

Tracing back the "continuity of thought" which he mentioned in *Muscular Contraction,* Fulton seems to have been struck particularly by two groups of forerunners—the humanists of the early sixteenth century and the founders of the Royal Society in the seventeenth. During 1931 he published learned papers on these groups (103, 107). Each of these essays was first read before a society, and lectures of this intimate kind remained a favorite medium, but in publishing such lectures he was always meticulous to provide precise "documentation."

Among the early Fellows of the Royal Society he was attracted particularly to Robert Boyle through community of interests and loyalties; the collection and study of Boyle's works lay probably nearer his heart than any other single subject among his manifold enthusiasms. His exhaustive *Bibliography of Robert Boyle* (115) was on the stocks at this time, for its preface is dated 1930 though it did not appear till 1932. This first large-scale contribution to formal bibliography is a monument to Fulton's early accomplishment under three aspects: assiduity and eagerness as a collector, intuitive power to analyze and judge the work of earlier periods, and expert precision in describing books. In the Heath Clark Lectures (383) of 1947 he justifiably called Boyle "an old friend," and he placed him with Francis Bacon and William Gilbert as one of the three pioneers of empirical science in a study (394) contributed to *Isis* in 1949.

The *Bibliography of Boyle* was followed by two Supplements (151, 367), and its final revision was the very last work of his life, the second edition (519) appearing posthumously in 1961. The prefaces to the sections of the Bibliography constituted the first thorough survey of Boyle's writings. They remain unsurpassed and were only slightly modified for the second edition. Though this includes the garnered information of a life-time, it was not quite Fulton's last word about Boyle, for while it was going through the press he gave his final judgment in a paper prepared for the tercentenary of the Royal Society (515).

There were also subsidiary studies closely linked with the "Boyle," such as the bibliography of Lower and Mayow (179) dated from Magdalen College, 1934, and dedicated to C. S. Sherrington. Fulton here records that his interest in the Royal Society was stimulated by Francis Gotch's address of 1918 on these "two Oxford physiologists." He had by now modified his first judgment of Mayow and here called him a "a popularizer, an enthusiastic student."

The "Epilogue" to this bibliography of Lower and Mayow deserves quotation, for Fulton expresses in it a good deal of what he believed made bibliography worth-while:

> The man will always be important, but he cannot be fully understood without knowledge of the intellectual and spiritual forces that nourished him. These forces can be re-created in large measure through bibliography, humanized bibliography if you will, in which the primary objectives lie not alone in detailed bibliographical anatomy, but in the more intimate features of a book: its dedication, preface, footnotes, addenda, and errata, not to mention textual changes in its various editions; these, the more personal attributes of a book, reveal the man who wrote it, the forces which shaped his work, and the audience which he strove to inform.

Though most at home in the seventeenth century, Fulton was almost equally interested in the humanists of the Renaissance. He read to the Elizabethan Club at New Haven in 1931 an inspiring paper (107) published under the title, "Early medical humanists: Leonicenus, Linacre, and Sir Thomas Elyot," which treats also at some length the Lyons circle of Champier, Dolet, and Rabelais; he returned to these humanists in later papers (e.g., 402, 494). He was never content merely to explore or describe the past but always linked it with current problems: in no. 494, for instance, he compares Linacre with Sir Clifford Allbutt, "a great humanist physician, a man interested in learning for its own sake, interested also in the backgrounds of modern doctrine, and as much interested

in the men who participated in the revival of learning as in the ideas which they advocated." In his generous memoir of Sir Frederick Banting (486) Fulton had already recorded some fascinating reminiscences of Allbutt.

The eighteenth century also appealed to Fulton: in 1932, for instance, he spoke at a meeting in the Boston Medical Library on "Haller and the humanization of bibliography" (117). Here he was in most happy vein, accepting the mockery of those who despise bibliography and leading his hearers from the discursive notes of Ferguson and Osler to the then lately reassembled collection of Haller's voluminous abstracts of books, and so to the thumbnail characterizations which give Haller's *Bibliothecae* their special significance. It is typical of Fulton's precision that when he published his paper he included detailed descriptions of the original issues of the four *Bibliothecae*.

He treated another aspect of the eighteenth century in a masterly study of the revival of science in England among the nonconformists of the Warrington Academy (142). This paper he read at Johns Hopkins just after Henry Sigerist arrived there and confessed in it to "impatience of the history of ideas recorded independently of the lives of those who created them. The most important part of an idea is the man who created it—how he lived, who his friends were, and what perchance he ordinarily took for breakfast"—a Rabelaisian point which Sigerist surely enjoyed.

This paper too is "floated to posterity" by its excellent documentation: lists of the medical men connected with the Warrington Academy, reproductions of portraits and unfamiliar scenes, precise bibliographical detail. He concludes with a just tribute to the "liberal humanising spirit" of the Warrington group and of Joseph Priestley in particular, tracing the inheritance of its traditions by the non-conformist Manchester College at Oxford, with which he had personal associations.

Fulton returned several times to Priestley's life and work, most notably in the paper of 1936 written with Charlotte H. Peters, where they provide a bibliography of his educational and scientific writings (199). Priestley's interests and achievement appealed strongly to Fulton the scientist and educator. The link which Priestley formed between England and America, and his passion for proof-sheets, made him congenial (no. 199, page 164).

Meanwhile in the middle thirties Fulton was ardently collecting books and gave account of some successful forays in three

notable works of "humanized bibliography": Fracastoro (16th century) 1935 (177); Galvani (18th century), 1936 (191); Kenelm Digby (17th century), 1937 (207).

The Fracastoro Bibliography was compiled with Dr. Leona Baumgartner and gives further evidence of Fulton's deep sympathy with the early humanists. He displays for the first time the wealth of his knowledge of Italian typography and literary history. It was also the first tribute to his fruitful friendship with Arnold Klebs and contains in its commentary many points of personal interest apart from its contribution to history. Years later, in his charming preface (415) to Sigerist's *History of Medicine,* he compared Sigerist's retreat at Pura to Fracastoro's at Sirmio four hundred years before!

The Galvani Bibliography, which was published in the then new London journal *Annals of Science,* is a masterly analysis of some 28 books and pamphlets, mostly little known. It clarified the course of events in these first experiments in electro-physiology. This work was done in collaboration with Dr. Cushing and made use of his wonderful collection. It is amusing to recall that Sherrington teased his two distinguished pupils for "wasting time on Galvani, when the real work had been done by Volta", just as he hardly allowed them to mention Vesalius in his hearing. To Galvani, as to so many other favorite subjects, Fulton returned again (455).

The little book on Kenelm Digby is one of the least known but perhaps the most charming of all Fulton's writings. His gaiety and enthusiasm were excited by this exotic character who brought the spirit of the Elizabethan adventurers into the sober circle of the Royal Society. Pirate, bibliophile, magician, scientist, romantic lover: Fulton's evocation makes us repeat what Horace Walpole said of Edward Herbert—"the reader to his astonishment will find that the History of Don Quixote was the Life of Plato."[2] Fulton evaluates Digby's debt to Harvey and Descartes and credits him with the first concept of reflex action. He provided, it need hardly be added, a careful account of Digby's books, based on the collection "brought together by L.P.F." To Digby as to Boyle he returned at the end of his life in a paper for the Royal Society's tercentenary (516), which contains a fresh judgment of Digby as a scientist.

2 *The Life of Edward Lord Herbert of Cherbury, Written by himself.* Strawberry-Hill, 1764. 'Advertisement,' leaf a2*b*.

The occasion of Dr. Cushing's seventieth birthday in 1939, followed so tragically soon by his death, led Fulton into a series of studies concerning his great master and friend, which culminated in the magnificent *Biography*. First there were the publications in connection with the birthday, notably the *Bibliography of the Writings of Harvey Cushing* (232), in which he collaborated with Louise Eisenhardt, then the tributes on his death as well as the tribute to Cushing's friendship for Klebs at the latter's seventieth birthday in 1940 (252), next the work on Dr. Cushing's library (306) and in particular on his Vesalius collection (301, 302, 305), and finally the *Biography* (337) with several subsidiary papers (335, 359, 368, 376, 462, 501), in some of which Fulton stepped outside his self-imposed reticence and gave more personal reminiscences of "the Chief," not without a wry smile at the quantity of duties which devolved upon a literary executor (349). By this time Klebs too had died and had left his library to join Dr. Cushing's and Fulton's own munificent donations in the Historical Library at Cedar Street, so some further essays (351, 352, 363) rounded out the story to include that enigmatic, fascinating personality A.C.K.[3]

The first large task which fell to Dr. Cushing's literary executor was the completion of his *Bio-Bibliography of Andreas Vesalius* (305), which in spite of war-time difficulties appeared at the quater-centenary in 1943. This great survey of Renaissance anatomy books was, Fulton recorded later (462), "only half-completed at the time of Dr. Cushing's death." Although, of course, the book could never have been undertaken without Dr. Cushing's life-long devotion both as collector and savant, it bears on every page traces of Fulton's knowledge, scholarship, and precision.

The catalogue of the *Harvey Cushing Collection of Books and Manuscripts* (306) was compiled by other hands under Fulton's direction, but *Harvey Cushing, a Biography* (337) was his own. This great book is a masterpiece, and marks the climax of John Fulton's historical work. Whether it was an advantage or an embarrassment to have a man of fiery genius for his subject is an open question. On the one hand, everything that concerned such a man was interesting: as Sherrington said, "Your spirits rise when Cushing comes into the room"; on the other, Fulton was involved with an almost unmanageable wealth of material and, as he recalled later (349), was expected to record the reminiscences

[3] Dr. Klebs had the reputation of being 'difficult' even with old friends; I take this opportunity of gratefully recording his long-continued friendship to me.

of every acquaintance, especially of those whom Dr. Cushing had ruffled. All these difficulties were triumphantly surmounted in a vivid portrait combined with a full record of Dr. Cushing's activities and achievement. Cushing's own Life of Osler set a high standard, but Fulton made an independent approach. He selected from Cushing's great store of letters and other memorabilia with the utmost skill and tact, and provided a connecting narrative, critical and informative, which was thoroughly lively. If the book has any fault, it is that of being over-full.

The studies entailed by Dr. Cushing's legacy ran through the intensely busy years of World War II, which yet were not without other historical enterprises on Fulton's part. The organization and activity of the Historical Library were recorded in a series of reports (277, 318, 328, 332), which are not mere statements of work well accomplished, but manifestoes of Fulton's vision and intentions. They cannot be dismissed as ephemera by anyone interested in his ideas.

Another "legacy" which Fulton adequately repaid at this time was his work on John Ferguson's unfinished researches on Polydore Vergil, the Italian humanist who settled in England and was the first historian of medicine. Fulton records that he had been interested in Polidoro as early as 1932, but the paper of 1944 (312) with its full bibliographical apparatus is the fruitful result of much research and also reports a remarkable dedication copy of Polidoro's *History,* newly acquired for Yale. Once more he showed himself a true bibliophile working from the personal minutiae of books, as he had recommended. Yet he fully valued the texts of the old writers and often insisted that students of history must be supplied with accessible source material; here, then, he prints excerpts and facsimile pages from Polidoro's history of physick.

Meanwhile in addition to his own researches and the organization of other work in direct support of the war effort, Fulton was promoting the compilation of a series of current bibliographies on aviation medicine and vision (290, 311, 321)). These large compilations, though the work of his associates, bear the mark of his intense care to use bibliographical styles suitable for special purposes without loss of precision (see 226, 227). They bear, too, a more direct impress of his hand in places. For instance, in Ruch's *Bibliographia primatologica* (275) he discussed Linnaeus' thought on the problems of classifying man among the animals. This is one of his few excursions into the bibliography of natural history (cf. 437, 500), for he was not a naturalist, in spite of his early

work in zoology and his profound knowledge of laboratory animals; his interest turned much more to the physics and chemistry of physiology, as he said in his *Selected Readings* (91). In Ruch's book also Fulton stated one of his irreducible principles: "having collected the literature on paper, we propose to collect it *in fact* in the library."

Soon after the war his early study of the anaesthesia pioneers bore fruit in his contributions to the Anaesthesia Centennial of 1946—permanent bibliographical records which I have discussed already. His war work and the wider researches of which it was a part were admirably surveyed in his Heath Clark Lectures on aviation medicine, given in London in 1947 and published as a book in the following year (383). This small book is a happy example of his method. Aviation medicine was then so new a subject that his subtitle, "an historical survey," hardly prepares us for a masterly account of the physiological background through three centuries. Many of the "old friends"—Boyle, Lower, Priestley —reappear, and there is a valuable critique of the work of Paul Bert, J. S. Haldane, and Joseph Barcroft. As he had said in *A Bibliography of Aviation Medicine* (290), much of this older work had "immediate significance," and he now insisted that "the facts of science take on fresh meaning in contemporary experience," for the most interesting part of the book was its survey of the latest researches in several branches of the subject.

In the aftermath of war Fulton was deeply concerned with the cogent educational problem of making the intelligent layman aware of the rapid advances of scientific discovery. Himself both scientist and humanist, accustomed to cross and recross the invisible frontier, he had much to say and said it both directly and through historical analogies. An article which he had published in 1941 on "Medicine and the sciences" (270) leads towards these educational articles. In it he had pointed out the need for a combination of biological and physical skills in "physiological thinking" and for "well-constructed bibliographical armour" for the historian of science.

The Garrison lecture of 1946 (344) sets out to explore "how the laboratory sciences have become insinuated into the structure of American Universities," and instances the growth of the Sheffield School at Yale and the Lawrence School at Harvard, both originally independent institutes. Once again he emphasizes the importance of the human element, in such pioneers as Willard

Gibbs, Louis Agassiz, and particularly Benjamin Silliman. The argument is pursued in the life of *Benjamin Silliman* (364), written with Elizabeth Thomson, which came out the next year, and in several essays deriving from it (369, 374, 401). Though intended for a more general audience than the Life of Cushing, this biography is a no less vivid humanization of old letters and records.

The other side of the problem, the symbiosis of science and humanities, was discussed in the Ludwig Mond Lecture (403) delivered at Manchester in 1949. Here again Fulton relies on historical precedents to make his case, drawing mainly on the seventeenth century and quoting the reactions of English poets such as Donne and Milton to the new worlds disclosed by telescope and microscope. He makes a plea for teaching the history of science and calls for a more adequate supply of reprints and translations of scientific classics. Similarly, in a chapter contributed to a festschrift on English thought and literature in the seventeenth century (416) he remarks that "our salvation as educators lies in a return to the spirit of that age, when those engaged in art and literature and those in medicine and the embryo sciences had some understanding of what transpired across the boundaries." Fulton's most direct appeal for "the new humanism, the broadest education possible, with grounding in both sciences and humanities" was made in the first Stimson Lecture (421) in 1951, where he discussed the contribution of her own scientists to the advance of America in several fields.

Though he never ceased to preach this gospel with its rider that "important history is often being made in our midst" (450) as shown in such a paper as "Medicine, welfare, and history" (451), or in his tribute to Louis H. Bauer (475), Fulton's interest turned again to more strictly historical and bibliographical studies. His Renaissance researches flowered in the masterly Servetus bibliography (434), compiled with Madeline Stanton, which for the first time gave an adequate account of the martyr of science, whose ghost had misled so many previous scholars; his opinion of Servetus' contribution to medicine was expressed in a further paper (448). He returned also to Vesalian studies in the first of his Clendening lectures (405), which is remarkable for its excellent and precise bibliographical detail; the second lecture gave a survey of the eighteenth-century scientists who most interested him. Certain aspects of this period were more fully discussed in his study of William Withering (437), which itself takes

up the story of the first Charles Darwin, Erasmus' son, recounted by Fulton many years earlier (166). He also gave a fresh account of Galvani (455), while he added a new name to his pantheon with a concise essay on "Mascagni and the lymphatics" (489).

The seventeenth century, however, remained his favorite territory. I have already mentioned his paper on seventeenth-century medicine in England (416), which displays his intimate knowledge of Pepys and Evelyn; more important were the renewed studies of Kenelm Digby (516) and of Robert Boyle (515, 519). The modern period, too, was never neglected: his tributes to Osler have been described, and with them we may place a series of sympathetic appreciations of Sherrington (360, 428, 435, 511, 514), as well as many shorter memoirs of other physiologists and scholars.

The most valuable historical work of the post-war years was his book on *The Great Medical Bibliographers* (410), based on his Rosenbach lectures. Here he brought together much little-known material, characteristically providing concise catalogues of the works which he discussed. In earlier studies he had only touched a small part of this material, for instance in his essay on Haller (117). He showed as always his instinct to turn individual men and to examine individual copies of their original books; nor did he neglect contemporary bibliographers, modestly omitting his own great contributions. Something of his habitual high spirits is conveyed in little humorous touches, and the whole book is as readable as it is useful. It was not mere history, but contained a plea for "humanist" values, though Fulton overlooked how much that hard-worked word changes connotation in each new period.

Such in outline was John Fulton's rich contribution to the history of science. He recorded in separate studies his knowledge of nearly one hundred men, bringing to light many half-forgotten names and perpetuating the memory of some of the most illustrious. Andreas Vesalius, Robert Boyle, William Osler, Charles Sherrington, Harvey Cushing—though their direct influence endures, we know them better through Fulton's advocacy.

Fulton's rare scholarship, both enthusiastic and meticulous, is clearly expressed in his penetrating biographies and his closely analytical bibliographies. We need not regret that the comprehensive works he once envisaged were not achieved; the special studies are monument enough. Their wealth of recorded knowledge ensures their permanence.

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Leibniz on Elliptical Orbits:

As Seen in his Correspondence with the Académie Royale des Sciences in 1700

I. BERNARD COHEN*

IN a famous letter to Leibniz written from Paris on 8 December 1700, Fontenelle, permanent secretary of the Académie Royale des Sciences (Paris), discussed the question of elliptic orbits. "Vous savés sans doute," Fontenelle wrote, ". . . que M. Cassini a abandonné l'ellipse de Kepler."

First published by Foucher de Careil a little more than a century ago,[1] this letter has remained a fragment torn from its context, no one having been able to tell why Fontenelle introduced the subject of Kepler and elliptical orbits. A few years ago, in one of the most renowned collections of autographs to be sold at public auction, there was a letter from Leibniz to Fontenelle which proves to be the mate to Fontenelle's letter about elliptical orbits and which indicates that Fontenelle's statement was a reply to a specific question raised by Leibniz. The *Collection Alfred Dupont,* sold at auction in 1956 and 1957, is commemorated in a heroic catalogue, with a preface by André Maurois. As described by Maurois:

> M. Alfred Dupont ne s'est pas proposé d'avoir *une* lettre de Descartes, de Balzac, de Victor Hugo ou de Lamennais, mais de trouver, pour chacun des auteurs auxquels il s'intéressait, *la* ou *les* lettres qui éclairaient un moment capital de la vie, la naissance d'une œuvre, ou un événement spirituel de première grandeur. L'étonnant est que, s'étant donné un objectif aussi difficile à atteindre, il ait si brillamment réussi.[2]

An examination of the sale catalogue bears out M. Maurois' judgment, for the collection contained major letters and documents of writers, musicians, and artists, scientists and philosophers, and of historians and men of affairs, many of them never published.

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1 A. Foucher de Careil. *Lettres et opuscules inédits de Leibniz, précédés d'une introduction* (Paris, Librairie Philosophique de Ladrange, 1854), pp. 198 ff. This letter was transcribed from the original in Hanover.

2 The catalogue is entitled *Précieux autographes, composant la collection de Monsieur Alfred Dupont.* Première partie, dont la vente aura lieu par le ministère de Me Jean Ribault-Menetière, 11 Boulevard de Courcelles, Paris, assisté de M. Michel Castaing, 3 rue Furstenberg, Paris, [&] M. Pierre Cornuau, 22 rue Lafitte, Paris. This first part listed 384 items (from d'Alembert to Zola), which were sold at auction on 11 and 12 December 1956. A second catalogue (Deuxième partie . . .) listed 302 items (from Agoult to Zola), which were sold at auction on 18 and 19 June 1957. There was a third part, of which I have not seen the catalogue.

Leibniz was represented in the collection by a number of significant documents, which are not to be found in the standard editions of his writings and correspondence.[3] Among these, item 211 (Catalogue, première partie) was a letter in French to the Abbé Bignon,[4] dated Vienna, 26 May 1714, in which he made a number of observations on the state of science. In part he wrote:

> La paix devenue presque générale me fait espérer que les sciences refleuriront sous vos ordres et qu'on ira en peu d'années de tranquillité plus loin qu'on n'était allé en 30 pendant les troubles. Il serait à souhaiter qu'on prit soin un peu plus qu'on ne fait des avancements de la médecine practique, en distinguant la simple hypothèse d'une conjecture plausible, la conjecture vraisemblable de la certitude des faits; mais par tout qu'on s'attachat d'avantage à faire et à enregistrer des observations; et je voudrais que tout médecin qui découvrit un aphorisme nouveau de practique véritable ordinairement et trouvé par l'observation, en eût le prix. Je ne considère plus les mathématiques pures que comme un exercice servant à pousser l'art de penser. Car pour la practique tout y est presque découvert depuis les nouvelles méthodes. Mais il n'en est pas de même de la physique où nous ne sommes que dans le vestibule. . .[5]

The comparison between mathematics and medicine is interesting, containing—as it does—the just observation about a simple hypothesis and a plausible conjecture. Clearly Leibniz was concerned with medicine as an art, and thus wished for advances on the practical side rather than for the elaboration of still more theories. The emphasis on "la certitude des faits," on an "aphorisme nouveau de practique véritable ordinairement et trouvé par l'observation," indicates a trend toward a purer empiricism than we are wont to associate with Leibniz' scientific thought. The reason is clear, however, when we take into account his evident desire to see medicine reaching the stage of producing cures for diseases. Although we may take it for granted today that chemistry and biology, or theoretical medicine itself, may influence practice in a fundamental way, in Leibniz' day it was far from obvious that the hypotheses that pervaded medicine were in any way related to sound practice or that the advances then being made

[3] All of these editions are fully described, and their contents listed, in Emile Ravier, *Bibliographie des oeuvres de Leibniz* (Paris: Librairie Félix Alcan, 1937). For errata and addenda see Paul Schrecker, Une bibliographie de Leibniz, *Revue philosophique*, 1938, *63*, 324-346.

[4] The abbé Jean-Paul Bignon, an Oratorien, conseilleur d'état and bibliothécaire du roi, was named président de l'Académie Royale des Sciences in 1691 and was reappointed annually until 1700; thereafter until 1734 he was appointed either président (14 times) or vice-président (16 times). See *Index biographique des membres et correspondants de l'Académie des Sciences.*

[5] As transcribed in the Catalogue. These transcriptions are faulty in that the texts are partially modernized. In one case in which a photographic reproduction is given, so that a check on the accuracy of transcription is possible, I have found a number of errors, such as the omission of a word.

in the sciences of chemistry and biology might be of real benefit to the medical art. Leibniz was certainly aggrandizing his own contributions when he wrote concerning the new methods in mathematics that as for practice almost everything had been discovered! Perhaps the most interesting statement in this extract is, therefore, that pure mathematics serves only as an exercise to "pousser l'art de penser."

Leibniz' declaration that in a few years of peace-time science would advance more than during the last thirty years of war is of more than passing interest. In the first place, it is difficult to see how the war might have impeded the progress of science, save for the difficulties of scientific communication and the actual meeting of scientists of different lands.[6] Furthermore, the span of thirty years—though corresponding to a chronological interval of hostilities—would go back to the year 1684, just prior to the publication of Newton's *Principia* (1687). In 1714, when Leibniz wrote this letter, the second edition (1713) of the *Principia* had just appeared. One cannot help thinking, therefore, that what Leibniz was saying in fact was that the new edition of this classic was not much of an improvement on the old one, and that physics or natural philosophy still had a long way to go.[7] This seems clearly to be the sense of the statement that although mathematics has advanced so very much, the case is not the same in physics, where we are only "dans le vestibule."[8]

[6] The extent of scientific communication between Englishmen and Frenchmen during this period is surprisingly great. On this subject see Sir Gavin de Beer, *The sciences were never at war* (London, Thomas Nelson & Sons [1960].

[7] Leibniz' criticism of the fundamental principles of the Newtonian natural philosophy were expressed strongly in his *Theodicée* (Amsterdam: chez Isaac Troyel, 1710; ed. 2, 1712) and in an exchange of letters with N. Hartsoeker published in the *Mémoires de Trévoux* for March 1712 and reprinted in that year in the *Journal des Sçavans* (December 1712) and the *Memoirs of Literature* (May 1712). Newton's answer to this criticism by Leibniz is contained in the General Scholium written by Newton to conclude the second edition of his *Principia* (1713), and in the preface written for that edition by Roger Cotes, who had done the revision of the whole text under Newton's direction. Newton wrote a letter of reply to Leibniz which is being edited for publication by A. Koyré and I. B. Cohen. (See Cotes's letter to Newton, 18 March 1713, in J. Edleston, *Correspondence of Sir Isaac Newton and Professor Cotes* [London, John W. Parker, 1850], p. 153).

[8] There may be some doubt as to whether, in the final sentence of the extract, the word *physique* means "physics" (i.e., natural philosophy) or "physic" (in the sense of medicine). Although the discussion of medicine in the early part of the letter may suggest the reading "physic," the context indicates a new subject rather than a return to the previous one, *médecine*. Furthermore, although the word "physics" did not come into general use in English until the nineteenth century, the French *physique* was current as an equivalent of "natural philosophy" in Leibniz' day, as in the title of Jacques Rohault's famous *Traité de physique*. In the Leibniz-Clarke correspondence, published as *A collection of papers which passed between the late learned Mr. Leibnitz and Dr. Clarke, in the years 1715 and 1716, relating to the principles of natural philosophy and religion* (London, printed for James Knapton, 1717). The word *physique* used by Leibniz (as in the sentence, "*Mais pour passer de la* Mathematique *à la Physique*. . . ." pp. 20-21) is properly rendered into English as "natural philosophy."

In another autograph letter in the Alfred Dupont Collection, Leibniz expressed his opinions to Bossuet on the nature of physics. Writing from Hanover on 8 April 1692, he criticized the author of the *Entretiens sur la pluralité des mondes,* Fontenelle,[9] and also the general Cartesian point of view. Since the allied concepts of miracle and machine appear so prominently in the Leibnizian criticism of the Newtonian doctrines during the second decade of the eighteenth century,[10] it is especially interesting to read Leibniz' views on these topics in 1692, just five years after the appearance of Newton's *Principia* (1687).

. . . J'ay oublié de dire cy-dessus que je demeure d'accord que tout se fait mécaniquement dans la nature, mais je crois que les principes mêmes de la mécanique, c'est-à-dire les loix de la nature à l'égard de la force mouvante, viennent des raisons supérieures et d'une cause surnaturelle qui fait tout de la manière la plus parfaite. Et c'est à cause de cela, aussi bien que de l'infini enveloppé en toutes choses, que je ne suis pas du sentiment d'un habile homme auteur des Entretiens de la pluralité des Mondes, qui dit à sa marquise qu'elle aura eu sans doute une plus grande opinion de la nature, que maintenant qu'elle voit que ce n'est que la boutique d'un ouvrier, à peu près comme le roy Alphonse qui trouva le système du monde fort médiocre; mais il n'en avait pas la véritable idée, et j'ay peur que le même ne soit arrivé à cet auteur tout pénétrant qu'il est, qui croit à la Cartésienne que toute la machine de la nature se peut expliquer par certains ressorts ou élémens . . . les machines de la nature sont machines partout, quelques petites parties qu'on y prenne ou plus tost la moindre partie est un monde infini à son tour et qui exprime même à sa façon, tout ce qu'il y a dans le reste de l'univers. . . . On peut dire qu'il y a de l'harmonie, de la géométrie, de la métaphysique et pour parler ainsi de la morale partout . . . chaque substance agit spontanément comme indépendante de toutes les autres créatures, bien que dans un autre sens toutes les autres l'obligent à s'accommoder avec elles. De sorte qu'on peut dire que toute la nature est pleine de miracles, mais de miracles de raison et qui deviennent miracles à force d'estre raisonnables. . . . Le véritable tempérament est d'admirer la nature avec connaissance et d'y reconnaistre que plus on y avance, plus on découvre des merveilles et que la grandeur et la beauté des raisons mêmes est ce qu'il y a de plus étonnant et de moins compréhensible à la nostre. . .[11]

9 Bernard Le Bovier de Fontenelle, permanent secretary of the Académie after 1697, was a Cartesian. On this subject see Charles C. Gillispie, Fontenelle and Newton, pp. 427-474 in I. Bernard Cohen and Robert E. Schofield, *Isaac Newton's papers & letters on natural philosophy and related documents* (Cambridge, Harvard University Press, 1958); F. Grégoire, *Fontenelle, une "philosophie" desabusée* (Nancy, 1947); Robert Shackleton's introduction to his edition of Fontenelle's *Entretiens sur la pluralité des mondes* (Oxford, Oxford University Press, 1955); Leonard M. Marsak, *Bernard de Fontenelle: the idea of science in the French enlightenment* (Philadelphia, American Philosophical Society [*Transactions*, vol. 49, pt. 7], 1959).

10 Notably in the Leibniz-Clark Correspondence. See, on this score, Alexandre Koyré, *From the closed world to the infinite universe* (Baltimore, The Johns Hopkins Press, 1957), ch. xi; and A. Koyré and I. B. Cohen, The case of the missing *tanquam*: Leibniz, Newton, & Clarke, *Isis*, 1961, 52, 555-566.

11 As transcribed in the Catalogue (première partie), item 209.

The most important of all M. Dupont's Leibniz letters, however, was one written from Brunswick on 3 September 1700. The occasion was the designation of Leibniz as one of the first *associés étrangers* of the reorganized Académie Royale des Sciences. When this reorganization took place late in 1699, eight places were created for foreign associates. Three who had been associated with the Academy before this time—Leibniz, Guglielmini, Tschirnhaus —were at once designated *associé étranger* by royal order, on 28 January 1699. Then, on the following 14 February 1699, the members of the Academy voted to make Hartsoeker and the two Bernoullis *associés étrangers,* and finally on 21 February 1699, the same honor was conferred on Roemer and on Newton. It is interesting to note that although as one of the first group of eight Newton is properly designated "premier titulaire," he was chosen in the third group and was the last man picked.[12]

The date of Leibniz' appointment was 28 January 1699, but his letter of acceptance was not written until 3 September 1700, a year and seven months later.[13] This holograph letter, written in French, was item 169 (deuxième partie), in the catalogue of the second part of the Dupont sale. It reads as follows:

Bronsvic, 3 Sept. 1700

Monsieur,

Lorsque l'Academie Royale de sciences me fait sçavoir par vostre entremise qu'elle agrée mon zele, et m'envoye en meme temps la patente de reception dans son illustre corps, elle donne un grand relief aux marques de sa bonté pour moy, car elle ne pouvoit choisir un meilleur interprete des ses volontés, et dont les lettres honnorent davantage celuy qui les reçoit. J'ay receu cette patente avec tous les sentimens possibles de reconnoissance, et si je ne puis meriter l'honneur qu'on m'y fait, et les sentimens favorables qui s'y trouvent; je tacheray de m'en rendre un peu moins indigne que je ne suis. C'est à quoy la nouvelle societé que Monseigneur l'Electeur de Brandebourg vient de fonder pour les sciences, et dont S.A.E. veut que j'aye quelque soin, me fournira peutestre les occasions, à fin que je puisse faire par mes amis, ce que je ne sçavois faire par moy meme; car on sera ravi de concourir aux desseins de l'Academie Royale, et de profiter de ses lumieres. J'attendray celles que vous me faites esperer Monsieur, sur l'Astronomie. Je souhaite sur tout de sçavoir si Messieurs Cassini et de la Hire et d'autres excellens Astronomes que vous avés sont encor contents des Ellipses de Kepler, ou s'ils croyent que d'autres lignes repondent davantage aux observations, et

12 The choice of the first group of *associés étrangers* is discussed in I. B. Cohen, Newton, Sloane, and the Académie Royale des Sciences, to be published in the *Mélanges Alexandre Koyré* (Paris, J. Vrin, in press).

13 According to the *Index biographique des membres et correspondents de l'Académie des Sciences.* I have not found a reason for the long interval between Leibniz' being appointed *associé étranger* and his letter of acknowledgment.

comment ils jugent qu'on les peut tracer en detail à l'egard de chaque planète.

Une habile Astronome croit que les Tables Rudolphines ou de Kepler pourroient servir [?] à l'egard du soleil et de la lune avec un peu de correction, qui est comprise dans le papier cy joint, sur le quel je vous supplie, Monsieur, de me procurer le sentiment de vos Astronomes, et même ce qu'ils jugent qu'on deuvroit faire à l'egard des autres planetes.

J'ay oui dire qu'on a fait dans l'Academie Royale, des Experiences sur les moyens de produire un feu actuel par la reaction, et je souhaitte de sçavoir ce qui en est, autant qu'il est permis de l'apprendre. Un jeune medecin m'a. . . .

Je ne doute point qu'on pense chez vous encore à d'autres desseins dignes de la grandeur du Roy, comme la description des arts méchaniques, la correction des cartes de la géographie, la continuation du méridien à travers la France.[14]

The questions put by Leibniz to Fontenelle in the missing part of the above text can easily be reconstructed because of the detail in Fontenelle's reply, dated 8 December 1700, which begins:[15]

Il faut que je commence par me justifier d'une apparence de paresse dont vous pourriés me croire coupable, si cependant on en peut être soupçonné quand il s'agit d'entretenir commerce avec un homme tel que vous. La lettre que vous m'avés fait l'honneur de m'écrire de Bronsvic, du 3 septembre dernier arriva pendant que l'Académie étoit en vacances et toute dispersée. Ainsi je fus obligé d'attendre qu'elle fust rassemblée principalement pour la pouvoir consulter sur cette correction des tables Rodolphines que vous m'envoyiés. La compagnie ne se rassembla selon ses statuts, que le samedi d'après la Saint Martin, et ce fut une assemblée publique où je ne pus lire notre lettre. Mais à l'assemblée suivante, je la lus, et il fut résolu que l'on examineroit cette nouvelle proposition sur les élémens du soleil et de la lune. Ce n'est que depuis deux jours, que j'ai sur cela le sentiment de l'Académie. Le voici:

L'époque que l'on propose de 1701 commençant pour le moyen mouvement du soleil, étant réduite au méridien de Paris, se trouve à quelques secondes près de celles que M. de la Hire a établie dans ses tables astronomiques, et peut être que cette petite différence vient de la disposition de l'équation du temps de l'un et de l'autre. Pour ce qui est de l'équation du centre du soleil, cet auteur propose la plus grande de 1°36′ 20″ aussi à quelques secondes près de celle de M. la Hire. Mais comme cet auteur, suivant ce qu'il dit, doit former la table entière de l'équation du centre du soleil, selon la méthode de Kepler, on juge qu'elle ne pourra tout au plus convenir avec le ciel, que dans le point de l'équinoxe du printemps dont il a parlé.

Pour le système de la lune on le croit nouveau, mais il faudroit l'examiner sur les observations célestes.

14 Save for the final paragraph, the foregoing transcription has been made from the photographic reproduction of the letter given in the published catalogue. Unfortunately, the second page of the letter is not reproduced. The final paragraph above is taken from the cataloguer's transcription which is not always reliable. A photographic copy of the entire letter is to be found in the Leibniz dossier in the archives of the Académie des Sciences in Paris.

15 Foucher de Careil (see note 1 above) has printed further letters between Leibniz and Fontenelle, but the sequence has major gaps.

Then Fontenelle turned to the query concerning elliptical orbits. Before discussing that part of the letter, however, a word may be said about the remainder of the letter in which Fontenelle discussed other questions raised by Leibniz. Fontenelle wrote that the naturalist Tournefort had gone to Greece and Asia by royal command, taking with him both a skilled draftsman and a botanist; his aim was "la recherche des simples." His Majesty, Fontenelle said, had also ordered that "l'on continuast la méridienne qui doit traverser la France"; Cassini was going to the Midi and would not return until he had traced the meridian from Toulouse to the southernmost part of the kingdom. Furthermore, three academicians were charged with "la description des arts"; they had begun with printing ("parce que c'est lui qui conserve la connoissance de tous les autres"), but other arts were not being neglected. Next Fontenelle turned to another question:

> Apparemment, monsieur, on ne vous a pas bien expliqué ce qu'on vouloit dire *par ce feu actuel que l'on produit par réaction.* Je ne sais ce que ce peut être. M. Amontons un des élèves, a proposé un moyen de faire travailler la feu pour mouvoir des machines, comme on fait travailler l'air et l'eau. D'un autre costé, M. Bernoulli de Groningue nous a écrit sur un phosphore qu'il fait à coup sûr dans le baromètre, mais ni l'une ni l'autre de ces deux choses ne me paroist convenir à ce qu'on nous a dit. M. Lémery, un des chimistes de l'Académie, nous a fait voir dans un matras un tonnerre artificiel, avec un feu qui circulait dans le matras. Je ne sais si ce seroit cela, mais enfin voilà tout ce que je connois d'expériences nouvelles de l'Académie où le feu soit entré.[16]

The letter concluded with an account of the new rules of 1699 which required an annual publication by the Académie Royale des Sciences of the history of the previous year. In it one would find "les pièces les plus importantes, telles qu'elles auront été données par les académiciens, et comme cette compagnie vous conte pour un de ses principaux membres, quand vous voudrés, monsieur, lui communiquer quelqu'une de vos découvertes, on sera ravi d'en pouvoir orner l'histoire." Fontenelle told Leibniz how strong the approval had been of the choice made by the Elector of Brandenburg in giving Leibniz the direction of "la nouvelle Société qu'il a fondée pour les sciences." With an apology for a long

[16] In the sequence of Leibniz-Fontenelle letters published by Foucher de Careil, the one immediately following Fontenelle's letter of 8 December 1700 is another from Fontenelle to Leibniz (Paris, 30 April 1701) in which he explained further: "*Le feu par réaction* dont on vous a parlé n'étoit certainement que l'expérience de M. Lémery; elle est imprimée dans son cours de chimie que vous connaissés. Ainsi je ne vous en dirai rien de plus" (p. 205).

letter, Fontenelle signed himself "avec beaucoup de zèle," Leibniz' "très humble et très obéissant serviteur."

In reply to Leibniz' question about the elliptical orbits, and in particular whether Cassini and La Hire were still content with them, Fontenelle wrote as follows:

> Vous savés sans doute, monsieur, qu'il y a longtemps que M. Cassini a abandonné l'ellipse de Kepler, qui est l'ellipse ordinaire, pour lui en substituer une autre, ou, au lieu de la somme des lignes tirées d'un point de la circonférence aux deux foyers, ce sont les rectangles de ces lignes qui sont toujours égaux. M. de la Hire ne paroit point s'être déterminé pour aucune courbe, et je vous avoue que je soupçonne un peu qu'il se trouvera à la fin, que les corps célestes n'en décrivent effectivement aucune qui soit régulière ni exacte. Cette irrégularité, renfermée cependant dans de certaines bornes, me paroît plus convenable à la physique, quoiqu'assés incommode pour l'astronomie.
>
> A cette occasion, je vous dirai, monsieur, que M. Varignon, l'un de nos plus grands géomètres, nous a donné depuis peu une méthode générale pour trouver les différentes *forces centrales* qui poussent une planète. Il n'a pas manqué en commençant cette recherche de nous rendre la justice qui vous étoit düe, et de nous dire que vous, monsieur, et M. Neuton, vous étiés les premiers et mêmes les seuls, qui eussiés porté la géométrie jusqu'à découvrir ces pesanteurs des planètes vers le soleil, outre cela comme M. Varignon ne se sert jamais que du calcul différentiel, et que par là il va fort bien, c'est une obligation continuelle qu'il a à l'auteur de ce calcul, et qu'il publie avec beaucoup de plaisir.

The ellipse of Cassini has sometimes been called the "Cassinoïde."[17] In an ordinary ellipse, there are two foci. These have the property that a line from one focus to the curve will meet a line from the other focus to that same point on the curve in such a way that the angle between each of the lines and the tangent at that point will be equal. Thus in an elliptical mirror a ray of light from one focus will be reflected so as to pass through the other focus. Another property of the ellipse, a defining property, is that the sum of the lengths of the lines drawn from each focus to any point on the ellipse is a constant, and in fact must be equal to the major axis of the ellipse. This is the true ellipse, or Kepler's ellipse, the section of a cone formed when a plane intersects a right-angled cone so as to produce a closed curve. Now according to the *Histoire de l'Académie Royale des Sciences,* année M.DCC.III.,

> Nous avons dit dans l'Histoire de 1700, que Kepler avoit changé en Ellipses les anciens Cercles du mouvement des Planétes, & qu'ensuite M. Cassini avoit aussi changé l'Ellipse de Kepler, qui étoit la commune, en une

[17] E.g., Louis Godin, *Table alphabetique des matières contenues dans l'Histoire & les Memoires de l'Academie Roïale des Sciences,* Tome II. Années 1699-1710 (Paris, La Compagnie des Libraires, 1729), p. 130.

nouvelle Ellipse, où au lieu de la somme des deux lignes tirées des Foyers, c'étoit leur produit qui étoit toujours égal à celui des deux parties du grand axe déterminées par un Foyer. Cette Ellipse répond mieux aux observations célestes, si quelque Courbe réguliere y répond exactement.[18]

In other words, in an ordinary ellipse, if F_1 and F_2 are the foci and P is any point on the curve, then if x and y are the distances to P from F_1 and F_2,

$$x + y = a \text{ constant.}$$

In a "Cassinoïde," or ellipse of Cassini, the distances x and y from the foci F_1 and F_2 to any point P on the curve have the property that their product and not their sum is a constant,

$$xy = a \text{ constant,}$$

and in fact this constant is the product of the two parts into which the major axis is divided by either focus.

The reason for calling this an "ellipse" is that it is a curve determined by two foci. The Marquis de l'Hôpital discovered a general rule for finding the tangent to any such curve and Pierre Varignon applied this method to find the tangent to any point on a Cassini ellipse.

The subject of elliptical orbits had arisen earlier; a discussion is to be found in the *Histoire de l'Académie Royale des Sciences* for 1700. Here, in the section of "histoire," it is said:

> On a grande inclination à croire que ce qui tourne se meut circulairement, les yeux sont naturellement pour le Cercle, à moins qu'ils ne voyent bien clairement le contraire, & par cette raison, l'on a toûjours crû que les Corps Celestes étoient mûs circulairement. D'ailleurs on leur a attribué je ne sçay quelle noblesse, à laquelle on a crû que le mouvement circulaire convenoit mieux, parce qu'il est égal & uniforme, & Copernic luy-même, tout hardy qu'il etoit, & tout desabusé des idées communes, à conservé ce Préjugé.
>
> Cependant quand les Observations Astronomiques ont été devenuës plus exactes qu'elles n'avoient encore été, il ne s'est point trouvé que la supposition des Mouvemens circulaires s'y accommodât.
>
> Kepler a été le premier qui a osé changer en Ellipses les Cercles que l'on faisoit décrire aux Planetes autour du Soleil. Il y a un foyer commun

[18] "Seconde edition, revûe, corrigée & augmentée," quarto (Paris, 1720), p. 68.

The "Cassinoïde" is also known as the "oval of Cassini," and is mentioned in many textbooks of analytic geometry. A full discussion may be found in Charles Briot and Jean-Claude Bouquet: *Leçons de geometrie analytique* (ed. 4, Paris, Dezobry, F^d^ Tandou et C^ie^, 1863), pp. 294 ff. See also H. Brocard's *Notes de bibliographie des courbes géométriques* (Bar-le-Duc, Imprimerie et Lithographie Comte-Jacquet, 1897), pp. 207 ff.

On the "Cassinoïde" in astronomy see Jean Baptiste Joseph Delambre: *Histoire de l'astronomie au dix-huitième siècle* (Paris, Bachelier [Successeur de M^me^ V^e^ Courcier], 1827), p. 263. In Jacques Cassini's *Elemens d'astronomie* (Paris, Imprimerie Royale, 1740), ch. 6, there is a discussion of this curve in which the author (the son of the discoverer) shows how to construct the curve geometrically and indicates how it fits the observations. I am grateful to Miss Judith Victor for research assistance on the "Cassinoïde."

à toutes ces Ellipses, & le Soleil y est placé, au lieu qu'il étoit au centre de tous ces Cercles. Par-là s'expliquent trés naturellement les differentes distances des Planetes au Soleil.

L'Astronomie s'est encore perfectionnée depuis Kepler, son hypothese n'a point satisfait entierement aux observations, & M. Cassini y a fait un changement. L'Ellipse de Kepler étoit l'Ellipse ordinaire, où la somme de deux lignes tirées des deux foyers à un même point de la circonference, est toûjours égale. M. Cassini suppose une autre espece d'Ellipse, où au lieu de la somme de ces deux Lignes, c'est leur produit qui est toûjours égal.[19]

In the section of "mémoires" for the same year may be found Varignon's paper on: "Des forces centrales, ou des pesanteurs necessaires aux Planetes pour leur faire décrire les orbes qu'on leur a supposés jusqu'icy."[20] This article begins with a statement concerning Copernicus and the deficiencies of his system.

Mais après luy, sont venus des Astronomes, qui avec un peu plus de Physique, n'ont fait aucune difficulté de faire mouvoir les Planetes avec des vîtesses réellement differentes dans chacune, & même de changer leurs orbes circulaires en Elliptiques, dont ils ont assigné deux especes. La premiere est de Kepler, & c'est l'Ellipse ordinaire, à laquelle Sethus Wardus (quoiqu'il s'y tienne) croit pourtant qu'on pourroit encore substituer les orbes circulaires, en se servant de deux points pris à distances égales du centre sur un de leurs diametres, comme l'on feroit des foyers de cette Ellipse. La seconde est de M. Cassini, laquelle consiste à avoir les produits des droites tirées de chacun des points de sa circonference à ses deux foyers, par tout égaux; au lieu que dans l'Ellipse ordinaire, c'est la somme de ces droites qui est par tout la même.

It is interesting to observe that, according to Varignon, "M. Newton & M. Leibnitz sont les premiers, & même les seuls que je sçache, qui ayent recherché ces pesanteurs de Planetes: les voici encore d'une autre maniere." The similarity between this sentence of Varignon's and that given in the "histoire" for 1700 (quoted above) is very marked. In describing this work to Leibniz, Fontenelle was careful to tell him that Varignon "n'a pas manqué en commençant cette recherche de nous rendre la justice qui vous étoit düe." He also told him that Varignon had told the members of the Académie that Leibniz "et M. Neuton, vous étiés les premiers

19 Quarto edition (Paris, 1703), p. 96.

20 *Idem*, pp. 218-219. Kepler abandoned circles and combinations of circles for planetary orbits, because only an ellipse would agree closely enough with Tycho's most accurate observations. Within a century, however, thanks to the telescope, it was already clear that Tycho's naked-eye observations were not so accurate after all, and that the orbits of planets are not truly ellipses. The ellipse, of course, holds only in an ideal case, say of a system with only one planet, because of perturbations. It is, perhaps, fortunate for the history of science that Newton still thought of planetary orbits as ellipses when he wrote his *Principia* and on that basis discovered the universal law of the inverse square of gravitation.

et mêmes les seuls, qui eussiés porté la géométrie jusqu'à découvrir ces pesanteurs des planètes vers le soleil."

Fontenelle pointed out that Newton and Leibniz had made the discoveries of planetary gravities by geometry, but that Varignon used only the differential calculus. This question, which I shall not discuss here, is the subject of a long study of the first applications of the calculus to dynamics; but it is interesting to note that Fontenelle told Leibniz—in relation to Varignon's success in using the differential calculus—of the "obligation continuelle qu'il a à l'auteur de ce calcul, et qu'il publie avec beaucoup de plaisir."

Leibniz was naturally interested in finding out whether or not the planets followed simple elliptical paths, and whether Cassini and La Hire were still happy about Kepler's ellipses. One cannot help wondering, however, whether his curiosity in this matter was not somewhat abetted by the thought that abandoning the ellipse might yet invalidate the Newtonian dynamics expounded in the *Principia.* After all, Newton's first ten theorems "proved" that planets move along ellipses; surely Leibniz would have found cause to rejoice if Newton's celestial mechanics could be shown to have a shaky foundation.

Medical Pioneers in Aviation

WILLIAM CARLETON GIBSON*

"Wonderful has been the development of the airplane; inconceivable has been the neglect of man in the airplane."

U.S. War Department Publication, 1919

MEDICAL men have been closely associated with human flight almost since its beginnings and thus have created a specialty of medicine which in a relatively brief space of time has built up its own history. In 1782 we find the brothers Montgolfier, who lived in France near Lyons, starting from first principles. They had read Joseph Priestley's treatises on the properties of air and in the kitchen of their home found that they could propel paper bags up to the ceiling by heating the air within them. As long as the source of heat was suspended on a metal tray beneath the bag, there seemed to be no limit to the ascent. Accordingly, these sons of a paper manufacturer made a balloon of linen and paper from a number of sections buttoned together, and on 5 June 1783, setting a little fire of straw and wool under it, they saw their balloon rise from the market place of their town of Annonay. Soon Paris was agog with the news, and the physicist Charles was instructed by the Academy of Sciences to investigate the matter.

The brothers now proceeded to Paris for the next logical step, that of sending passengers aloft. Again using the hot-air principle, they saw their balloon ascend and descend safely on 19 September with its passengers—a sheep, a duck, and a chicken. Two months later, on 21 November, after experiments with humans in a tethered balloon, Pilâtre de Rozier, a surgeon of Metz, and the Marquis d'Arlandes ascended freely in a hot-air balloon. The King had wished to send up two criminals first but was dissuaded by the aeronauts who sought the distinction for themselves. Benjamin Franklin watched the ascension and was asked, it is said, of what use was a balloon. His rejoinder is well-known—"What good is a newborn babe?" Franklin went on to conclude that balloons would now ensure world peace, since they could sail over towers and walls of fortresses, rendering them useless! Pilâtre de Rozier's balloon covered something over five miles in 25 minutes.

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Meantime Professor Charles had been busy launching a hydrogen-filled balloon, the gas being entrapped by taffeta covered with a rubber solution. (The Montgolfiers had given up hydrogen because it penetrated their paper covering.) In England Jenner was soon filling balloons with hydrogen in the great hall of Berkeley Castle and releasing them over Gloucestershire, some with poetry attached, asking for their safe return to him. What might be termed the sub-specialty of pediatric aeronautics began in Baltimore the following year when on 24 June a 13-year-old boy, Edward Warren, was airborne for a few moments in a 'Montgolfier.' This same year, 1784, saw two notable ascents in England, the first by Vincent Lunardi, the secretary to the Neopolitan Embassy in London. His fellow-passengers included a dog and a cat, but the latter hopped out during a temporary touchdown. The wine and food became mixed with the sand ballast, but otherwise Lunardi's two-hour flight was considered a success. By the time Michaelmas term was about to begin at Oxford, James Sadler, a confectioner of that delightful city, made his first of many flights in a 'Montgolfier' and, as an historian of the time records, "received the approbation of the entire University"—surely the first and last time that an Oxford tradesman has been thus honored. Queen's College, Oxford, won for the University on 19 February 1784 the honor of putting up its first balloon, a hydrogen-containing pilot type about five feet in diameter. Three days later a similar small balloon was released at Sandwich, Kent, crossed the Channel, and landed near Lille.

As soon as the success of the Montgolfiers had been announced, the great Swiss mathematician and physician, Leonhard Euler (1707-83), set out to derive formulae expressing the rate of descent of balloons. James Tytler (1747-1805), a Scottish surgeon, ascended to a height of 350 feet from Comley Gardens in Edinburgh. He has been described as:

> a surgeon who failed in practice, an apothecary who was obliged to close his shop, a husband who was deserted by his wife, a proprietor of a laboratory which did not cover expenses, a debtor who sought the refuge of Holyrood House, an historian whose book was never finished, an editor whose periodicals suspended publication, a hack who wrote much of the second edition of the Encyclopedia Britannica (at the rate of seventeen shillings a week).

In London the physician and chemist George Fordyce spent a day and a night filling Lunardi's balloon with hydrogen, made from sulphuric acid and zinc, while 200,000 people waited im-

patiently. Even Joseph Black, the Scottish chemist who had discovered carbon dioxide while a medical student, now took to laboratory ballooning, and we find him trying to make a small aerostat from a calf's bladder filled with hydrogen. The French aeronaut Blanchard took the British anatomist Sheldon aloft while the latter tried out a motor-driven propeller without success. Next, Blanchard ascended with his financial backer, Dr. John Jeffries of Boston, who because of political difficulties at home had graduated in medicine at Aberdeen. Jeffries wanted to measure the physical properties of the atmosphere at various heights, as suggested by Cavendish. Accordingly on his first flight with Blanchard he carried a Toricelli mercury barometer and instruments for measuring the temperature, moisture, and electric disturbances in the air. He carried little bottles filled with water, which were emptied at altitude for the purpose of bringing back air samples. His results are certainly up to modern standards, and he stands out as a serious student among a cloud of merely hopeful travellers.

While all this was going on in England, the surgeon-aeronaut Pilâtre de Rozier was laboring in France to prepare a combined hot air and hydrogen balloon in which to cross the Channel to England. In September 1784, he and Pierre Romain signed an agreement for this purpose and set about building the complicated and dangerous machine at the Tuileries in Paris. Their target date for crossing was 1 January 1785. The Government of France advanced a large sum of money for the construction, and soon Pilâtre de Rozier had to resort to one of those political face-saving devices in aviation which have cost so many lives since. The further the preparation proceeded, the worse the problems became, and Professor Charles warned that a match was being put under a powder keg by introducing a hot-air furnace below a hydrogen-filled bag. De Rozier had the mistaken notion that the way to regulate altitude most easily was to put a little more fuel on the fire, or conversely to damp it with water from a sponge, during flight.

The irrepressible Blanchard, unwilling to allow his countryman to precede him across the channel, announced a flight with Dr. Jeffries from Dover to France for December 1784. Though all was ready, they had to wait the better part of a month for favorable winds and weather, and finally on 7 January 1785, they cast off from Dover. According to some historians, the Governor of Dover Castle had to intercede in a quarrel between the two, as Blanchard wished to exclude Jeffries from the flight entirely, saying that

there was no room in the basket. There was room, however, for an odd assortment of flags, anchors, life jackets, brandy, biscuits, apples, pamphlets, and letters. As the balloon rose Jeffries was moved by the magnificence of the white chalk cliffs at Dover. Half way across the channel he became aware that a serious leak had developed in the balloon, and that only extreme measures would see them safely on the French shore. Thus, the ballast and apparatus just listed had to be jettisoned, and Jeffries offered to jump into the sea himself if it would get the balloon across. However, an updraft of air caught them and deposited them a little distance inland, whereupon began two months of festivities in France!

Sad to relate, it was close to this spot that Pilâtre de Rozier and Romain crashed fatally six months later while attempting their long-postponed flight in the opposite direction. The Marquis de Maisonfort, the superior officer in Boulogne, had approached Pilâtre just before the take-off, offering a large sum of money to be included as a passenger. He even had one foot on board, says one historian, but was turned back because de Rozier said he was not sure enough of the balloon. One thing that weighed heavily on de Rozier was the personal debt which he had accumulated because of the enterprise. The Minister in Paris rejected all further bills submitted, and his creditors were closing in on him. Some think that he had taken out a passport for England and Holland some time previously in order to flee his creditors. The fatal ascent took place one day before he was to appear in the debtors' court in Boulogne. The Marquis de Maisonfort, the rejected passenger, states that no fire took place, and that the wreckage showed no charring. He attributes the sudden collapse of the balloon to the precipitate opening of the hydrogen valve and the tearing of the deteriorating fabric. Thus began the long series of mysterious aeronautical deaths which we know only too well today.

The idea of mechanical propulsion and guidance in balloon flights occurred to many. We have noted Sheldon's unsuccessful attempts. Jeffries and Blanchard used a "moulinet," a forerunner of the propeller, to no avail. The German medical graduate and physicist, Christian Gottlieb Kratzenstein, practising in Copenhagen, proposed propellers in his book, *L'art de naviguer dans l'air,* which he dedicated to Professor Charles. Hugh Bell, a London physician, also attempted propellers and steering gear in balloons without success.

The practice of aerial photography seems to have begun with a medical student, Felix Tournachon, popularly known as Nadar. He was born in 1820 and, despite the wildest ballooning career in history, lived to the age of ninety. There is no suggestion that he ever finished his medical training, but for an aeronaut he studied in the right cities—Lyons and Paris, where ballooning history began. In 1858 from a height of approximately 1700 feet, he took the first aerial photograph of Paris. Strangely enough, such a development had been forecast for more than ten years by the cartoonist Maurisset in the science fiction comics of France. This has a familiar ring to those who, sworn to secrecy in World War II, found in the comic strips of the newspapers accurate details of the latest and even projected devices.

Nadar produced in 1863 the largest spherical balloon ever made. It was 144 feet in diameter and held 262,000 cubic feet of gas. A small army of Paris seamstresses was called out to sew together more than 200,000 square feet of taffeta. The "basket" beneath the great gas chamber was in this instance the size of a two-story house. Journeys of eight days were contemplated in The Giant, as it was named. Twenty-four passengers in full dress took off from Paris in the first flight, dining well and casting the remnants of their meal to the earthbound below. The following day they found themselves over Hanover. As a low-altitude storm approached, an argument broke out between the pilot and the proprietors—similar to those which go on today in poorly regulated airlines—with near-fatal results. By pulling on the valve cord, passengers caused the monster to deflate. The bag, however, served as a potent sail for some time, while deceleration took place—in what we would consider today a model fashion—spread out over thirty minutes, thus decreasing the impact. However, all manner of structures and trees on the ground were demolished and a few fractures were suffered by the first-and-last occupants. Thus we see two further problems in aviation safety appearing: conflict between aeronauts and those with a proprietary interest in flying, and safe methods and areas for deceleration.

Once it had been demonstrated that there were likely to be upper limits to the size of balloons, men soon came forward to defy the limits of altitude which Nature had imposed on them. Those of the Victorian era were not apt to be forewarned by Robert Boyle's writings two hundred years previously on *The Spring and Weight of the Air;* and were certainly not to be put off by the

acute and detailed reports of travels in South America by Father Joseph de Acosta in the late sixteenth century. His account, published in Salamanca in 1588, may have reached Oxford ears, because of the long connection between the two centers of learning, but it was not brought home to the Victorians.

What had Father de Acosta written? Here, pieced together, is his account of the lack of oxygen in high places:

> In certain parts of the Indies the air and the wind blowing there dizzy men, not less but more than at sea. . . . There are other deserts or uninhabited places, which in Peru they call Punas, where the quality of the air cuts body and life from men without their feeling it. . . . In this place there blows a little wind which is not too strong or violent. But it is so penetrating that men fall dead of it almost without feeling it, or maybe fingers and toes are left there. . . . I am convinced that the element of the air is in this place so thin and so delicate that it is not proportioned to human breathing, which requires it denser and more temperate.

On one of his five crossings of the Cordillera he said of his companions, "Some . . . demanded confession, thinking verily to die."

The nineteenth century became famous for balloon ascents by scientists in search of the secrets of the upper atmosphere. On 30 January 1804, the Russian otologist Sacharof, along with the aeronaut Robertson, ascended over St. Petersburg to make scientific observations on hearing, pulse rate, and respiration at high altitude. The management of their balloon became so difficult that much of the apparatus, and even Sacharof's fur coat, was dropped, landing on the astonished crowd below. Both pulse and respiration were observed to increase at an altitude of 8,000 feet, but little of importance came from the flight. However, the celebrated Frenchman Gay-Lussac, later in the same year, ascended to 6,500 metres and made some excellent observations. Almost fifty years were to elapse before the physician Bixio ascended with Barral in a balloon heavily laden with recording instruments. The balloon was so badly constructed that when they reached 5,200 metres the envelope herniated down over their heads like the greater omentum, threatening to crush them. Barral stabbed the envelope with his knife and the pair were almost asphyxiated by the hydrogen which billowed out upon them. They vomited profusely. Within seven minutes they were back on the ground, having slowed what otherwise would have been a fatal descent by throwing overboard everything they had in the way of ballast and protective clothing. In typical French fashion, however, it is re-

corded that they "had the honor to preserve their instruments." Their predicament calls to mind the problem of asphyxia in the air from inhaling noxious gases, such as carbon monoxide, sometimes liberated by aircraft heating units, as well as the dangers of inflating flotation gear, for example life jackets, at high altitudes.

While French aeronauts were chilled by the experiences of Bixio and Barral, two hardy British pioneers, Glaisher and Coxwell, ascended in 1862 to 29,000 feet, as registered on their barometer. Glaisher's voyage, financed by the British Association for the Advancement of Science, took place at Wolverhampton. At 26,000 feet Glaisher could not see his instruments, became deaf, and was also paralyzed in all four limbs. Coxwell, a most skilled operator, is said to have pulled the valve cord with his teeth, so incapacitated was he. This near-fatal episode set the stage for a real tragedy.

Three French balloonists, spurred on by Glaisher's altitude record, now prepared to ascend to 8,000 metres. They had had the advice of Paul Bert on certain aspects of the projected ascent, but he was away from Paris when the oxygen requirement was being decided. Sivel, Croce-Spinelli, and Tissandier reckoned that a total of 150 litres of oxygen in a container would suffice since the balloonists would breathe it only when they felt they needed it. They mentioned this to Bert in a letter, and he warned at once that for such altitudes the three men would require at least 20 litres per minute, and that the projected total of 150 litres was absolutely insufficient. His letter arrived after the flight had begun.

The records of the tragic episode show that several miles up Tissandier was too weak to get his gloves out of his pocket to protect his freezing hands. At 7450 metres the temperature was 10 degrees below zero. Tissandier nevertheless continued to scribble, almost illegibly, with cold hands, and his companions closed their eyes. Sivel was roused to cut loose more sandbags. Tissandier's record—"Sivel throws ballast. Sivel throws ballast,"—is a good example of anoxic perseveration and a sad reminder of the loss of judgment which had taken place.

They passed 8,000 metres, as their instruments showed, and then started to descend. Eventually all awoke and threw out more ballast, although they had in fact reached their goal of 8,000 metres. They really did not know what they were about, as they tossed over clothing and even an oxygen aspirator. This was a crude moistener in which the oxygen coming from the storage

tanks was bubbled through water flavored with tincture of benzoin. (Evidently the process for manufacturing oxygen had left an unpleasant odor in it.) This bubbling aspirator probably allowed no oxygen to get to the men once the water within it froze over. The balloon now rose to 8,600 metres, as the barometer tube recorded. All were unconscious. When at last the balloon returned to earth only Tissandier was alive. Most of the oxygen in the inadequate tanks had never been used.

As Paul Bert wrote, this tragedy shook France. The idea that two men could die *in the air* had something of a ghostly tinge to it. Some scientists very wisely suggested pressurized cabins, of the type we have today. Paul Bert replied acidly, "Nothing thus far seriously proposed is worthy of the charming mystification of *A Voyage to the Moon,* and Jules Verne will pardon me if I do not discuss it." Within three years Bert had produced his great book, *La Pression Barometrique.* We see the role of the catalyst played by John Fulton in having this remarkable classic translated in the midst of World War II* by Dr. and Mrs. F. A. Hitchcock at Ohio State University.

Aviation medicine owes its roots to Boyle and Bert. To Yale University also this specialty of medicine and physiology owes a great deal. In 1911 a combined Oxford-Yale expedition carried out far-reaching and basic researches concerning human physiological problems at altitude on Pike's Peak in Colorado. (Strangely, Pike the soldier explorer had never been able to climb his own peak.) C. G. Douglas and John Scott Haldane of Oxford, with Yandell Henderson and Edward Schneider of Yale, went to the top in a cogwheel railway, up a 25 per cent grade. The publication of their results came just a year before World War I. In 1917 Haldane returned to Yale to give the Silliman Lectures, entitled *Organism and Environment as Illustrated by the Physiology of Breathing.* He pursued these studies further in his classic entitled *Respiration,* which was published by the Yale University Press in 1920.

The value of knowing the history of one's discipline is manifest in Haldane's introduction: "I have been largely influenced by the ideas and work of older physiologists. If, however, I have gone backward, it is only to pick up clues which have been temporarily lost; and all of these clues lead forward—forward to a new physiology which embodies what was really implicit in the old."

* *Barometric pressure.* Translated by Mary A. Hitchcock and Fred A. Hitchcock, Columbus, O., College Book Co., 1943.

We have run a little ahead of the main theme in following to its logical conclusion the story of anoxia. It should be added that the pressurized cabins suggested after the French tragedy of 1875 did not come into common use until 1945. In the interim pressurized breathing was devised, and I had the honor of working on it in World War II with Professor Cuthbert Bazett of the University of Pennsylvania when he came to Canada after the death of Sir Frederick Banting to assist with physiological problems of aviation. The late Squadron Leader Alec Fraser of McGill's Department of Pharmacology took the apparatus to the European Theatre for us. It allowed photo-reconnaisance squadrons to operate at 45,000 feet before the Invasion began. The role of Lovelace and Boothby in designing the American system of pressurized breathing must also be acknowledged here. After the war their apparatus came to be used successfully in cases of pulmonary oedema.

The initiation of powered flight by the Wright brothers brought in its wake a new set of medical problems. Before touching upon these, however, let us recall briefly the association of medical graduates with early researches on powered aircraft. Dr. James Bell Pettigrew (1834-1908) published an important book in 1873 entitled, *Animal Locomotion, or Walking, Swimming, and Flying; with a Dissertation on Aeronautics.* He looked upon the wings of birds as segments of a propeller, and he stressed the elasticity of the wing as a means of lateral control. This was to be the secret which the Wright brothers discovered in their years of gliding over the sands of Kitty Hawk, North Carolina. To my mind, these men provide one of the most interesting and incredible studies in modern times. They wrote in a very matter-of-fact way to the Smithsonian Institute that they had decided to fly and would like to have such and such publications sent and certain questions answered. Wilbur Wright has written of those days:

> My own active interest in aeronautical problems dates back to the death of Lilienthal in 1896. The brief notice of his death which appeared in the telegraphic news at the time aroused a passive interest which had existed from my childhood, and led me to take down from the shelves of our home library a book on "Animal Mechanism" by Prof. Marey, which I had already read several times. From this I was led to read more modern works, and, as my brother soon became equally interested with myself, we passed from the reading to the thinking, and finally, to the working stage.

About 1870 the medically trained Etienne Jules Marey (1830-1904) built a small centrifuge, in the form of a rotating circular

table, with which to investigate the supporting and lifting power of curved surfaces, such as the wings of birds. In addition he devised a camera which would take 60 exposures per second on a moving film, and with this he analyzed the movement of birds ascending and descending in flight. He built a flapping model of an insect which worked quite well to show the principles of powered flight, albeit of limited horsepower. Thus, Marey carried out in his laboratory in Paris what Lilienthal demonstrated in his more than 2,000 flights made with wings which supported his own weight for downhill distances of 400 yards. Wright paid tribute to Lilienthal, who was killed by crashing from a height of sixty feet in such a glide: "Lilienthal not only thought, but acted; and in so doing, probably made the greatest contribution to the solution of the flying problem that has ever been made by one man."

We must pass to the pioneers of our subject who changed the course of the First World War. I think first of Leonard Hill, whose book on caisson disease and his works on circulation, especially cerebral circulation, are milestones of our art. When he stole Martin Flack from his anatomical colleague, Sir Arthur Keith, at the London Hospital just before the outbreak of war in 1914, he stole a good man. As a medical student cutting thousands of histological sections in the kitchen of Keith's house down in the village of Borden, Kent, Flack had discovered the sino-auricular node of the heart. Between games of golf, teacher and pupil worked out the conducting system as we know it today. Attached to the air force in wartime, Flack set out a series of tests for fitness to fly, to which we must return with all speed today if we wish to make flying safer for pilots and passengers.

In the United States Edward Schneider of the Pike's Peak experiments became the physiologist to the American Army Air Force, with an army shack for his laboratory at Mineola on Long Island, New York. Here his fitness test was worked out; it survived into World War II. Here also Lyster, Wilmer, Jones, and Lewis drew up the standards of fitness for aircrew and directed that a motion picture should be made to demonstrate vestibular function in flight. This was done in the basement of the Surgeon General's Library in Washington. Leonard G. Rowntree made a remarkable study in 1918 of the accidents plaguing American flyers. He showed that for every flyer killed in combat three were killed in accidents. As Louis Bauer put it, "Not everyone could fly." What a tragedy, therefore, that the labors of highly skilled researchers should be

brought to naught in 1920, when Mineola was closed and all the records burned. This comes too close to the dismantling of Yale's aviation medical unit in 1945 to need further comment.

There is not space here to go through the fields of decompression sickness, motion sickness, acceleration and blackout, night vision, and air ambulances. Yet the historical approach is the only one which yields results applicable to future practice. The German air force generalized from its experience with air ambulances in the so-called Spanish Civil War of 1936-38, flying non-stop from Madrid to Berlin with injured German soldiers given adequate oxygen. They were years ahead of us in building a human centrifuge, as well as in jet helicopters.

One wonders if aviation medicine is dead. Did it cease to exist with the end of the war? The answer is a definite No. If we were to apply to cases of air embolism in our hospitals the lessons of denitrogenation learned in Canadian and American laboratories during the war, we would save more lives. If we used long-established physiological techniques to exclude from aircrew both fainters and epileptics, we would have fewer fatal crashes. If we studied the cerebral circulation in all pilots over the age of 50 years—and the means to do this are at hand in every good hospital today—we would solve some of the problems which bedevil aviation today, problems which are not political but clearly physiological.

This story, therefore, will have been worth recounting if only to recall the intensity of the effort which has been poured into human physiological research in the service of aviation for almost two centuries and which can serve us still if we will but allow it.

Some Bibliographers of Early Medical Americana*

FRANCISCO GUERRA**

Of all his varied works, none was more representative of John Fulton's character than his book, *The Great Medical Bibliographers*. He possessed unique qualifications for surveying the lives and deeds of his predecessors in that field—Champier, Gesner, Haller, Billings, Choulant, and Osler—and his survey has been much admired. However, he did not include anyone with a particular knowledge of the literature of the New World other than Billings and Garrison. When I remarked on this, he urged me to gather information on the rich American traditions in medical bibliography. The list which follows (selective because of limitations of space) is the result of his encouragement.

Contributions to the bibliography of early medical Americana —medical books printed in this hemisphere during the colonial period or relating to it—have come from many sources. The general bibliographers of those cultures responsible for the conquest and colonization of the American continents were the first who made a record of American medical authors and their works. As a result of this general approach, their information was fragmentary and incomplete when compared with the works of bibliographers who compiled chronological records of printing in a given American country or in America as a whole, for the work of this second group necessarily provided more systematic and accurate documents. Only a few special bibliographies have reviewed the medical productions of the American nations, or surveyed the literature available in North America on a given topic, though it should be added that the paucity of medical bibliographical material is due partly to the fact that medicine and bibliography each call for special training and techniques, and it is rare that the finished product satisfies both physician and bibliographer. Imbued with admiration for American books, I began to follow in the footsteps of the great American bibliog-

* This investigation was supported by U.S.P.H.S. Grant No. 6394 from the National Institutes of Health.

** Present address: The Wellcome Historical Medical Library, The Wellcome Building, Euston Road, London, N.W.1, England.

raphers and thus learned much about their lives, works, sources, and libraries. Sometimes it was possible to acquire books from their collections and to study once again the very copies of medical books which were handled by the older bibliographers. Twenty-five years of search for medical Americana have taken me from the Humboldt Codices in Berlin to the Western Americana collections in California, and from the Osler Library in Montreal to the Medina Archives in Santiago de Chile. Many a sentimental journey has been made into the province of the American bibliographers, and it was an enthralling experience to study in the Archivo de Indias in Seville, and to work in the very same house where León Pinelo, the first American bibliographer and the first man to write about the medical authors of the New World, had lived.

European Medical Bibliographers

Occasionally European medical histories include references to some American authors, and the same is true of general medical bibliographies. It is noteworthy that military surgeons in Europe, as in America, have tended to spend their frequent leisure hours in bibliographical studies. In Spain there have been two masters of medical biobibliography who occupy positions comparable to those of Billings and Garrison in the United States, and they had three centuries of medical imprints to cover.

Antonio Hernandez Morejón (1773-1836), born in Alaejos, Old Castile, later moved to Valencia. He entered the medical school there in 1793, and his excellent work won him on graduation an appointment as instructor in anatomy. In 1815 he became surgeon-general and clinical professor at Madrid, enjoying the highest reputation.

Hernandez Morejón built up the most complete library of Spanish medical authors ever known. It included the works of many Americans, as the detailed descriptions of them in his work reveal. Unfortunately these American works did not go to the library of the medical school in the Central University of Madrid, where the rest of Hernandez' work and books are preserved. Soon after his death, friends published posthumously his *Historia Bibliográfica de la Medicina Española* (Madrid, 1842-1845) in seven compact volumes. More than a century has gone by since its publication, but despite progress in historical and bibliographical techniques the work of Hernandez Morejón remains a standard

of accuracy in most entries. The material, which is organized chronologically, covers the evolution of Spanish medicine, with articles on the authors and their works and, in addition, a good review of their contents. Medical publications pertaining to America from the fifteenth century are included, and the number of authors and books surveyed is impressive. A general alphabetical index, whose lack handicapped users of the bibliography, has been recently provided.

Anastasio Chinchilla (1801-1867), born in Ayora, near Valencia, first studied philosophy and theology at the Orihuela Seminary and subsequently attended medical school both at Valencia and at Madrid. After graduation he entered the army and until 1836 campaigned in the Spanish Civil Wars, attaining the position of surgeon-general in the Valencia area.

Chinchilla's work, *Anales históricos de la Medicina en general, y biográfico-bibliográficos de la Española en particular* (Valencia, 1841-1846), was printed five years after the death of Hernandez Morejón. Chinchilla published eight small folio volumes, two of which were devoted to a general history of medicine, one to a history of surgical procedures, and the remainder to Spanish medicine, including many American authors. Although Chinchilla organized his work in precisely the same fashion as Hernandez Morejón, he treated some works in a manner quite different from that of his predecessor. It is easy to sympathize with Chinchilla's bitterness when charges of plagiarism were made against him.

BIBLIOGRAPHERS OF THE NEW WORLD

The quantity of bibliographical contributions relating to America is enormous; even the bibliography of bibliographies is extensive, and the number of sources for medicine is considerable. To keep this survey within reasonable bounds it is best to focus attention on the traditional bibliographers of the New World who have dealt with major cultural areas—British, Spanish, or Portuguese—and add a selection of good national bibliographies, and, in some cases, a handful of medical bibliographies, in order to illustrate the projection of those works in the history of medical sciences.

Antonio de León Pinelo (*c.* 1590-1660) is generally thought to have been a native of Lima, Peru, where he was graduated in canonical law in 1617; however, it is more probable that he was

born of Spanish-Jewish parents in Valladolid or Lisbon. The family apparently emigrated to Buenos Aires in 1604 and travelled through the River Plate to Chuquisaca, where León Pinelo received his early education. Although he was appointed an attorney to the Royal Court in Lima in 1618, as well as comptroller of the famous mines of Potosí, Pinelo's literary aspirations induced him to leave for the Spanish Court in Madrid, where he arrived probably in 1619. His extensive early travels, his legal career, and his literary vocation were all factors which contributed to the style and subject-matter of his later works. In 1623 he published a study of American laws based on the collection of Royal Decrees which he had made and presented to the Council of the Indies. His positions at Madrid and Seville and the research he carried out in the Simancas Archives and other Spanish libraries were the foundation for works relating to legal matters in the American dominions, and at least one article relating to medicine—that on American beverages—which appeared in 1623.

His principal work was the *Epitome de la Biblioteca Oriental i Occidental, Nautica i Geográfica* (Madrid, 1629). As the title implies, it was divided into four major sections; the medical authors of the New World appeared in the second part, or occidental library (section XXV, pages 127-132), dealing with natural histories of the Indies. This section included medical books known in 1625 as well as works on natural products, materia medica, and physical problems of America. León Pinelo supplied the author's name, short title of the work, language in which it was written, date of printing, and, in the case of unpublished work, the location of the manuscript. Although more detailed information has been offered in subsequent bibliographies, one of the unique characteristics of Pinelo's work is his splendid coverage of medical manuscript material then extant.

Andrés Gonzalez de Barcia (1673-1743) should rank next to León Pinelo because he complemented the latter's work. While he was engaged in reprinting Herrera's *Decadas,* Gonzalez de Barcia had occasion to consult Pinelo's *Epitome* and hit upon the idea of enlarging the latter work by the addition of titles preserved in his private collection and other materials which came to his notice. The resultant work was a revised version of Pinelo's *Epitome* (Madrid, 1737-1738), which appeared in three large folio volumes. Some bibliographers in recent years have pointed out that frequent errors detract greatly from the value of a book which

is otherwise excellent; this truth may be confirmed by referring to many medical authors recorded in these pages. An unusual aspect of this book is that the editor's name appears nowhere in the three volumes, an astonishing gesture of modesty and one not often emulated by other bibliographers.

Joseph Sabin (1821-1881) was an antiquarian turned bibliographer. Born at Braunston, England, he received his primary education at Oxford, though he did not enter the University. He learned the book trade there with C. Richards and after his marriage in 1848 left England for New York and Philadelphia. For a time he was engaged in book-auctioning and in the preparation of catalogues (he turned out about 150 in his lifetime) and after some activity in the rare-book world, he settled in New York with the declared intention of publishing a *Bibliotheca Americana.* In 1865 Sabin retired from business and devoted himself to private sales of books and prints and to the publication of his life's work, the *Dictionary of books relating to America, from its discovery to the present time* (New York, 1868-[1881]). He had reached volume 12 at the time of his death, but the work was continued up to volume 20 by Wilberforce Eames for the Bibliographical Society of America, and then completed in 1936 by R. W. G. Vail. It came to 29 volumes and a total of 106,413 entries. Sabin covered the British-American area fairly well, and the final volumes by Eames and Vail are even more accurate. Arranged in alphabetical order by the authors, the short title, printer, place and date of imprint, editions, and some locations are given. Medical books are listed, but the medical historian must fish such references out of a sea of general literature.

José Toribio Medina (1852-1930) was the prince among bibliographers of Americana. Born in Santiago de Chile, he was forced by his father into the legal profession but he vastly preferred the study of fossils and entomology. The award of a university prize for his Literary History of Chile stimulated him to further his bibliographical research in the archives of Peru and in Europe, particularly in the rich collections of Spain. Medina's efforts seemed at first to be oriented toward the literary and political history of Chile, but this changed about 1882. Two important decisions in his life can be traced back to that date; the first was to amass the greatest private collection of Americana, the second, to produce a definitive bibliography of Colonial Spanish possessions in America and Asia. As the result of incredible effort Medina

managed to triumph in both undertakings. In the ensuing years, of which ten were spent in travelling, Medina collected American imprints, manuscripts, maps, and auxiliary material on a scale which has seldom been surpassed, and, be it remarked, his activities were not hampered by strong competition from income tax dodgers! It is a universal truth that no true bibliophile has ever had sufficient funds to satisfy his collecting urge, and Medina, like many other book collectors, occasionally had to find ways to supplement his funds. One such transaction was the sale in 1903 of his Philippine collection to Pedro Vindel (1865-1921), the Madrid bookdealer, for a mere 10,000 pesetas; Vindel said later that by this purchase he obtained the best Philippine books known to the world at that time.

The contributions made by Medina to medical bibliography are extremely important. The six folio volumes of his *Biblioteca Hispano-Americana (1493-1810)* (Santiago de Chile, 1898-1907), contain records of the medical books referring to Spanish America and printed in Europe, including not only Spanish editions but also reprints in other languages. Medina also established the pattern of medical bibliography by issuing separate bibliographical inventories of every Spanish town which housed a printer, from the time the press was set up to the end of the colonial period. The technique he established was excellent; all the entries were arranged by chronological order of imprints and included the complete transcript of title pages by line, full collation, locations, references, table of contents, notes about the author and the book, and record of the sale of any copy. The medical historian has only to peruse Medina's work and screen the medical imprints listed therein.

Medina's reputation rests largely on his work as a bibliographer and historian, though he was interested in such varied subjects as anthropology, numismatics, cartography, geography, literary criticism, natural history, philology, linguistics, and above all in book collecting. It is a fascinating experience to work with his collection in the National Library in Santiago de Chile and diverting to trace his visits to institutions—he made six trips to Europe, twice visited the United States, and journeyed several times through Spanish America—and hear his contemporaries relate how he would appear, enveloped in a Mephistophelean cape equipped with capacious pockets for the better concealment of books purloined while the bookshelves were being surveyed. The same kind of anecdote is

retailed about García Icazbalceta, León, and other fanatical bibliophiles. It is not widely known that Medina also had the enviable joy of printing his own books at his private press, acquired in 1888.

In the course of fifty-two years of active bibliographical work—from 1878 to 1930—Medina produced a total of 392 books and pamphlets amounting to 81,235 printed pages, carrying accurate, detailed descriptions of 62,682 imprints; to these figures should be added over 7,500 biographies, more than 5,000 illustrations and facsimiles, in addition to records of manuscripts, coins, and maps incorporated in the books about the thirty-one countries which he studied bibliographically. To visualize the almost unbelievable extent of his superhuman work it is enough to remember that his complete works take up nearly sixty feet of shelving. Medina was without question the foremost American bibliographer, and every historian dealing with Spanish American medical imprints is compelled again and again to turn to his work for the soundest references.

The Author (1916-) was born in Torrelavega, Spain, and was first guided to a love of books and book collecting by M. Cascón (1880-1958), the bibliographer of M. Menéndez y Pelayo (1856-1912) that colossus of Spanish bibliography, the author of *La Ciencia Española* (Madrid, 1887) and many other important studies. On his arrival in Mexico in 1939 after the Spanish Civil War the author was overwhelmed by the cultural heritage before him and the wealthiest bibliographical tradition in America. A physician specializing in pharmacology, he began to orient himself in history and philosophy, focussing on the field of American studies in particular. While at Yale between 1942 and 1944, he came into close contact with Arturo Castiglioni (1874-1953) and with John F. Fulton and his associates at the Historical Library, where study of the history of medicine was well launched.

A knowledge of books may perhaps be perfected by training, but bibliophiles are born and not made, and a true bibliophile is impelled to share his love for books with others of his creed, and with them to study the books themselves. In Mexico City there was, as there had always been, a group of book lovers; one such group was presided over by *Demetrio S. García* (1883-1948), a native of Burgos, Spain, a doctor of canonical law but also an antiquarian bookdealer and bibliographer. García guided the rest of the gathering along the right road. *Guillermo Echaniz* (1900-), a Mexican antiquarian, added his archaeological scholarship to

the group. *Salomon Hale* from Poland was a true representative of the great European collecting tradition, possessed of a love and intuition for quality. To this group were added from time to time the contributions of collectors and bibliographers from all over the world; but the vital element which kept them together was their mutual love for books, and their weekly gatherings were enlivened by the exchange of news about acquisitions and literary discoveries.

Between 1941 and 1950 a compilation of the known medical imprints of the old Spanish Colonies in the New World was made, and in 1950 *La Obra de la Medicina Española en America* was presented to the Real Academia de la Medicina in Seville, as an historical introduction to medicine in every colony. This work contained a complete bibliographical description of the medical books relating to America, or by American authors printed in Europe, and including the medical imprints of the colonial American Vice-Royalties—Santo Domingo, Cuba, Mexico, Guatemala, Nueva Granada, Peru, Chile, and Rio de la Plata. In all, the work covered a great part of the medical production in the New World during the colonial period, with the exception of the French, British, and Portuguese establishments. The delay in publication resulting from the size of this work (some nine volumes) was partially compensated by a summary entitled *Historiografía de la Medicina Colonial Hispano-Americana* (Mexico, 1953); this monograph was organized on a similar outline, omitting the detailed bibliographical inventory of American medical imprints, although sound references to historical works relating to medicine for the areas in question were retained. Though other books have since appeared and some minor additions should be made in its pages, it remains a faithful guide to work on colonial Spanish American medicine.

This early search for material impressed the author with the urgent need for a reliable medical bibliography of the early pre-Columbian and colonial periods for the New World as a whole, and he has long been embarked on this enterprise.

Canada

Marie Tremaine (1902-), though born in Buffalo, N. Y., was taken to Canada at an early age, and subsequently obtained her bachelor's degree at the University of Toronto. After experience gained in London and Yale University she was appointed head of the reference department of the Toronto Public Libraries

in 1927 and remained there until 1947. During that period she published important works on Canadian imprints, a *Bibliography of Canadiana,* 1934, and *Canadian Book Printing,* 1940. Her *Bibliography of Canadian Imprints, 1751-1800* (Toronto, 1953) is the basic Canadian reference work and reflects the author's technical skill in the bibliographical arrangement. At the present time she is working in the Library of Congress on the preparation of the Arctic Bibliography. Miss Tremaine's work is arranged in chronological order and the bibliographical data for each imprint are accurate, even to the locations, and include the Canadian medical imprints to 1800.

UNITED STATES OF AMERICA

Charles Evans (1850-1935), a native of Boston, was appointed while still young to a position at the Boston Athenaeum, where he became increasingly absorbed in the field of Americana. After 1872 he held appointments in libraries in Indianapolis, Virginia, and Chicago. In 1903, after several years of preparation, he embarked on the publication of his *American Bibliography* (Chicago, 1903-1959). The printing of this work was suspended after volume 8 in 1914 and resumed in 1925. Evans died while he was completing volume 12, and his work has been concluded by the American Antiquarian Society with volume 14 in 1959, thus covering all printing in the United States between 1639 and 1800. Evans' book contains 39,162 entries of imprints arranged chronologically, giving the author's name (with dates of birth and death in some instances), the title of the imprint, place, printer, and date; the pagination and size are usually followed by locations, which are very restricted, and occasionally by market prices for some exceptional items. Every volume contains an index of authors, subjects, and printers. This immense work is fairly accurate and affords good coverage of the literary production of North America. A supplemental volume of titles discovered since "Evans" was completed is in preparation. Use of the volumes has been made much easier by the addition of an index volume. The titles which Evans classified as pertaining to medicine before 1783 can be expanded, but because of its scope, accuracy, and chronological pattern Evans' work remains the backbone for any study of the United States. His work has been complemented by many other local bibliographies, but such works lie beyond the scope of this paper.

Joseph Meredith Toner (1825-1896), an American physician who came closest to an appreciation of the importance of medical bibliography, was a great book collector with a special interest in medical Americana—as any good bibliographer should be—and his collection is preserved at the Library of Congress. However, the works which he wrote on bibliography have remained largely unpublished and must be consulted among the mass of Toner papers in the Manuscript Division.

Thomas Archibald Malloch (1887-1953) in his *Catalogue of an Exhibition of Early and Later Americana* (New York, 1927) reveals his appreciation of the bibliographical problems of Americana.

Francis Randolph Packard (1870-1950) devoted one chapter in his *History of Medicine in the United States* (Philadelphia, 1901; new edition, New York, 1932) to medical books printed in the United States prior to 1775.

Harriet Rogers (1898-), of Pennsylvania, studied at Columbia University, where she submitted for the degree of M.Sc. a dissertation on *Books in Medicine, Botany, and Chemistry Printed in the United States before 1801*. This work follows the chronological pattern and bibliographical style of Evans.

Robert B. Austin (1905-) in his position at the National Library of Medicine, Washington, D. C., became aware of the urgent need for a guide to the early medical literature of this country, and was inspired to prepare a *Check List of Medical Books Printed Prior to 1821* which appeared in 1959 for private institutional checking. A revised and corrected edition was published in 1961. The check list is arranged in alphabetical order of authors and gives the standard references for librarians, thus providing them with a most useful tool.

The Author has been working since 1958 on medical Americana, which will be exhaustively covered in an *American Medical Bibliography, Colonial Period and Revolutionary War, 1639-1783*, to be published in 1962. This work is a chronological catalogue and a critical and bibliographical study of books, pamphlets, and broadsides, in addition to almanacs and articles in periodical publications, printed in the present territory of the United States of America up to 1783. Similar studies of other American areas are to be the subject of further research.

Bernhard Wolf Weinberger (1885-1960) occupies a unique position as the historian and bibliographer of dentistry. In *An Introduction to the History of Dentistry in America* (St. Louis, 1948) the bibliographical survey is fairly accurate for the United States. The only weak point in Weinberger's work is that he presents the bibliographical lists by alphabetical order of authors, instead of chronologically.

MEXICO

José Mariano Beristain y Souza (1756-1817) was born in Puebla, Mexico, entered the priesthood, and taught theology at the University of Valladolid, Spain; because of his royalist sympathies he was harassed by political difficulties during the Mexican struggle for independence. His *Biblioteca Hispano-Americana Septentrional* (Mexico, 1816-1821) consists of three large volumes. This work, reprinted in 1883 and 1947, offers biobibliographical references of great importance, including manuscript medical material which is difficult to trace nowadays and is always worth surveying.

Joaquin Garcia Icazbalceta (1825-1894), whose literary career began with a translation of Prescott's *Conquest of Peru*, 1849, was responsible for editing and publishing important documents relating to the early history of Mexico, and also for a beautiful work on the bibliography of that country. He turned his attention to medical works in a paper on the Mexican physicians of the sixteenth century and particularly in the *Bibliografía Mexicana del Siglo XVI* (Mexico, 1886), printed under his supervision, in which he gave detailed descriptions of the first printed medical books of the New World. García Icazbalceta possessed one of the finest collections in Mexico (a country which has for centuries housed the best libraries of the continent), gathered together at a time when fine books were comparatively easy to obtain from the spoils of religious orders. Long after his death it was still possible to find medical imprints from Icazbalceta's collection, though most of them had been sold, together with the manuscript collection, to the University of Texas. A catalogue of the manuscript material was prepared in 1927 by the specialist in pre-Columbian codices, *Federico Gomez de Orozco* (1891-). *Agustin Millares Carlo* (1893-), a native of Las Palmas, Canary Islands, who arrived in Mexico in 1939, has produced the greatest contemporary bibliographical work on Americana; he has also

recently edited and enlarged García Icazbalceta's work, with interesting medical contributions.

Nicolás León (1859-1929) was a man to whom book collecting and medical bibliography were of paramount importance and who contributed most to medical bibliography and history in Mexico. Born in Quiroga, Michoacan, he received his early education by the beautiful lake of Pátzcuaro, and studied in the medical school at Morelia, graduating in 1883. A year later he founded the Michoacan Museum, where many archaeological relics of the Tarascan Indians were gathered together. Although he was appointed director of the Museum in 1885 and also received the appointment of clinical professor of surgery at the University, he moved to Oaxaca, to which he became very attached and where he died. In 1886 and 1887 he wrote some historical works on Michoacan medicine, but his most important and mature works were published after his arrival in 1900 at the Archaeological Museum in Mexico City, where he worked until he returned to Oaxaca in 1929. León travelled abroad and always kept up an interesting correpondence with bibliographers and bookdealers.

Nicolás León is not by any means an easy figure to judge; arriving in Mexico ten years after his death, the author tried to obtain an image of the man through the words of his contemporary friends and enemies and, above all, through his works. He was even able to buy medical books from three of his libraries; although biographers usually refer to three sales from the catalogues prepared by León himself—the first printed in 1896, the second 1897 (sold in one lot to the John Carter Brown Library), and the third in 1914—there was in fact another sale which was handled for Sir Henry Wellcome by Fielding H. Garrison, from which Garrison apparently managed to set apart a good lot. In addition, there were many small sales through Hiersemann in Leipzig and, finally, the sale carried out after León's death by Mex Libris in 1930. The story goes that León's extraordinary luck in collecting began when he obtained from the Superior of the Augustine friars a letter which permitted him to take all the duplicates in the Augustine monastery libraries in payment for legal assistance which he had given the Order in some involvements with the Mexican Government. León produced more than thirty books and papers relating to medical bibliography and history in Mexico, in addition to several hundred other papers chiefly related to bibliography. His important contributions to

medical bibliography are the *Bibliografía Mexicana del Siglo XVIII* (Mexico, 1902-1908), six large volumes in folio, covering chronologically the production of the Mexican press during the eighteenth century on lines very similar to the work of Medina; and a *Biblioteca Botánico Mexicana* (Mexico, 1895). His other works include *La Obstetricia en Mexico* (Mexico, 1910), which contains an exhaustive bibliography of obstetrics, and *Los Precursos de la Literatura Médica Mexicana,* published in the *Gaceta Médica de Mexico* in 1915, which is the acme of applied medical bibliography. This monograph covers the medical imprints of Mexico from 1570 to 1833 in chronological order, affording for the first time an accurate record of 179 works, with notes about the authors and the content of their books. The titles are transcribed by line, with printer, place, and date; the paginations are correct, and some tables of contents or facsimiles are included. There can be no doubt of León's profound knowledge of his field and of the magnificent work he carried out in medical bibliography. But one rather disconcerting thing about him is the insouciant way in which he disposed of many medical treasures; it appears that once he had handled them they had no further value for him.

José T. Medina, despite previous and later bibliographical work by other authors, remains the standard authority with his *La Imprenta en México (1539-1821)* (Santiago de Chile, 1907-1912), in eight volumes, and the complementary surveys of other Mexican cities, such as *Guadalajara (1793-1821),* 1904, *Mérida (1813-1821),* 1904, *Veracruz (1794-1821),* 1904, and *Puebla (1604-1821),* 1908. Each of these volumes gives accurate bibliographical details about medical imprints.

The Author had the advantage of the work of previous bibliographers. At first it appeared that the medical imprints of Mexico numbered 315, according to the bibliographical research carried out by Medina to 1821 and León to 1833, but when the periodical articles were regrouped, it was found that the imprints listed by León up to 1833 numbered in fact only 179. However, in his *Iconografía Médica Mexicana* (Mexico, 1955) the author made a descriptive catalogue of 832 titles, with facsimile reproductions of all the title-pages of printed medical material of Mexico between 1552 and 1833. Each entry includes the author's name, title, printer, place of printing, date, pagination, and size. Other contributions made by the author to the field of Mexican bibliography include a *Bibliografía de la Historia de la Medicina Mexicana*

(Mexico, 1949) and a *Bibliografía de la Materia Médica Mexicana* (Mexico, 1950), with 5,357 entries recording every printed publication referring to Mexican natural products used in medicine up to 1950.

Samuel Fastlicht (1902-) was born in Sambor, then in Austria but now part of Poland, and arrived in Mexico in his youth. After graduating in dentistry from the University of Mexico in 1932, he specialized in orthodontics. Fastlicht came to bibliography rather later than most of the authors we have already mentioned, as he first explored the field of archaeological research, becoming an authority on pre-Columbian dental mutilations. When he did enter the world of bibliophily he applied himself energetically to acquiring bibliographical information and built an important library. The friendly advice of another historian and bibliographer, B. W. Weinberger, had a decisive influence on its development, and Fastlicht has recently acquired the Weinberger collection. The *Bibliografía Odontológica Mexicana* (Mexico, 1956) offers a chronologically arranged record of every Mexican dental imprint to the middle of this century, together with accurate descriptions and facsimile reproductions. No other country has a similar systematic bibliography of dental literature.

GUATEMALA

José T. Medina recorded in *La Imprenta en Guatemala (1660-1821)* (Santiago de Chile, 1910) the imprints of Guatemala during the colonial period and provided the usual accurate descriptions so typical of his work. However, the same weakness found in his Mexican coverage pertains also to Guatemala: Medina does not pay sufficient attention to the theses of medical graduates.

José Antonio Villacorta Calderón (1879-) in his *Bibliografía Guatemalteca* (Guatemala, 1944) recorded some of the medical theses from the old University of San Carlos. Villacorta practised law after his graduation, though he is known for his contributions on Mayan codices in addition to archaeological studies and other publications of historical interest.

Nathan Van Patten (1887-1956) was born in Niskayuna, New York. His work on medical imprints and early scientific literature may be traced to his position as librarian at the Massachusetts Institute of Technology and afterwards at Stanford. Because of the Spanish American material preserved at the Lane Medical

Library and the influence of the California environment, Van Patten turned his attention to bibliographical studies of early medicine in Spanish America. His work should be included in the Central American area because of his *Medical Literature of Mexico and Central America,* 1930, and *Medical Literature of Guatemala,* 1932.

THE ANTILLES

Antonio Bachiller y Morales (1812-1889) has been considered the father of Cuban bibliography, because of his *Apuntes para la Historia de las Letras . . . de la Isla de Cuba* (Habana, 1859-1861); this record of the literary production of Cuba won him the highest acclaim.

José T. Medina produced *La Imprenta en la Habana (1707-1810)* (Santiago de Chile, 1904) and *La Imprenta en Santiago de Cuba* (Santiago de Chile, 1904) including a certain number of medical imprints.

Carlos Manuel Trelles y Govin (1866-1951) is without doubt the most important of Cuban bibliographers. Born in Matanzas, Cuba, he studied medicine at Havana for four years but became involved in the Cuban struggle for independence and was exiled in Tampa. Upon his return to Cuba after the end of the Spanish-American War, Trelles was appointed librarian of the Public Library in Matanzas and in less than a year increased its holdings from 2,000 to 13,000 volumes. Visiting France during an International Exhibition, Trelles became acquainted with modern bibliographical techniques. In 1923 he was appointed librarian to the House of Representatives and of the Martí Library in Havana. His first important work was his *Ensayo de una Bibliografía Cubana de los Siglos XVII y XVIII. Seguido de unos apuntes para la Bibliografía Dominicana y Portorriqueña* (Matanzas, 1907; Supplement, Havana, 1908). The work covers the early imprints of Cuba, Santo Domingo, and Puerto Rico and includes descriptions of medical works. The material was greatly enlarged in the eight volumes of the *Bibliografía Cubana del Siglo XIX* (Matanzas, 1911-1915). His medical training was an advantage when he surveyed the Cuban medical imprints in the *Biblioteca Científica Cubana. Ciencias Médicas . . .* (Matanzas, 1919), a volume which also included a section devoted to books on engineering. From 1906 to 1907 he published a *Bibliografía Médico-Farmacéutica Cubana* and in addition to many other publications made a defini-

tive critical survey of the medical contributions of Cuban physicians in *Contribución de los Médicos Cubanos a los progresos de la Medicina* (Havana, 1925). The work of Trelles is extensive and most informative, even though it does not afford systematic bibliographical descriptions of the imprints discussed.

Frank Cundall (1858-1937), an Englishman educated at King's College, London, in 1891 became secretary and librarian to the Institute of Jamaica, where one may see the fine collection of Jamaican imprints which he patiently gathered together. This collection and his bibliographical contributions, *Bibliotheca Jamaicensis* (Kingston, 1902), *Bibliography of the West Indies* (Kingston, 1909), from which Jamaica was excluded, and *A History of Printing in Jamaica from 1717 to 1834*, are of importance to medicine, for Cundall offered unique descriptions of the medical imprints of Jamaica and was able to preserve most of them in his collection. Most unfortunately, the books which Cundall gathered together have deteriorated from the combined effects of time and the wrong kind of chemical preservatives. Jamaica was an early center of medical printing, and work is now in progress to expand and complete Cundall's work, with particular emphasis on medical books and journals, though this research is still far from completion.

Rulx León (1890-) a native of Haiti and a distinguished physician and historian, has published the best supporting information about the French period in *Notes Bio-bibliographiques. Médecins et Naturalistes. . . .* (Port au Prince, 1933). For the period of Independence, León's bibliographical contributions, published in medical magazines, afford an excellent survey of the medical production of Haiti. It is a tragedy that since 1957 the work of this scholar has been halted by complete blindness.

The Author has been working recently on the medical imprints of Jamaica, Haiti, and the Lesser Antilles with encouraging results. Jamaican imprints have been regarded so far the most important, but the presses of Haiti produced several books and magazines before 1804 which are of great interest and are, moreover, hitherto unknown to medical historians. All the Caribbean medical publications contain contributions relating to syphilis, yaws, yellow fever, and tropical diseases which should not be overlooked. It is amazing to find that the little islands of Antigua and Barbados had, in the colonial period, a tradition of medical printing more important than that of Canada.

COLOMBIA, VENEZUELA, AND ECUADOR

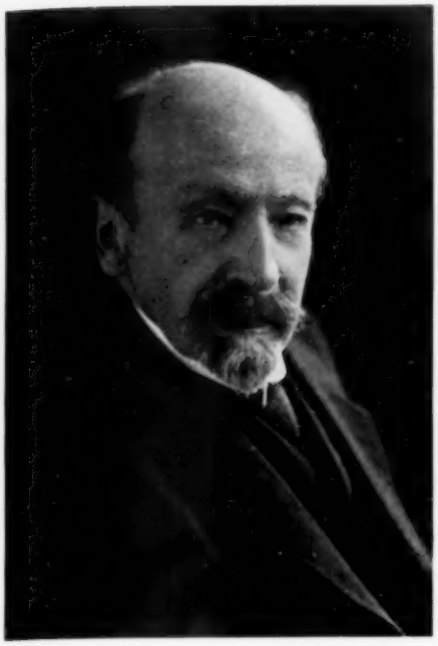
These countries should be studied together in an historical analysis of the colonial period and should include Panama which was a Colombian province until the present century; during the Spanish dominion these countries were all grouped in the Vice-Royalty of New Granada.

José T. Medina has surveyed chronologically the literary production of the presses in this area. *La Imprenta en Bogotá (1739-1821), La Imprenta en Cartagena de Indias (1809-1820), La Imprenta en Quito (1766-1818), La Imprenta en Caracas (1808-1821),* in addition to other minor works, were all published in the same year (Santiago de Chile, 1904). The survey of this area was not an easy task, and there were some omissions in Medina's work which have only recently been supplied by *Pedro Grasses* (1909-) working in Caracas.

Eduardo Posada (1862- ?) was born in Medellin, Colombia, studied law in Bogotá, and was one of the founders of the Academy of History in that city. He worked on the completion of Medina's work in Bogotá, first publishing *La Imprenta de Santa Fé de Bogotá en el Siglo XVIII* (Madrid 1917), and then writing a more extensive work in two volumes, *Bibliografía Bogotana* (Bogotá, 1917-1925), which contained good descriptions of the medical imprints of Bogotá after 1821.

Federico Gonzalez Suarez (1844-1917), the archbishop and renowned historian, published a *Bibliografía Ecuatoriana* (Quito, 1892) but his survey of the years between 1750 and 1792 was superseded by Medina's work, for the latter provided better bibliographical descriptions of early medical pamphlets in Quito.

Ricardo Archila Medina (1909-) was born in Apure, Venezuela and was graduated from the school of medicine at Caracas in 1934. His bibliographical work is without peer in his chosen area, and he has been able to exhaust the records of medical literature in Venezuela from its beginnings to the present day. Although Archila was graduated in public health (Johns Hopkins, 1940), his activities in that field in Venezuela have been interpolated by documented studies of local medical history, such as his *Historia de la Obstetricia en Venezuela* (Caracas, 1955), *Historia de la Sanidad en Venezuela* (Caracas, 1956), *Historia Médica de Venezuela, Guayana* (Caracas, 1958). The work of particular



Portraits of José Medina (*upper left*), Carlos M. Trelles (*upper right*), Nicolás León (*lower left*), and Hermilio Valdizán (*lower right*).

Map depicting early medical printing in America. The geographical limits of the political territories during the colonial period are shown with the dates of colonization and independence. The figures in parentheses give the number of medical imprints known to exist for each area.

importance for bibliography is his *Bibliografía Médica Venezolana* (Caracas, 1946), which was subsequently enlarged in 1955 and again in 1961. Archila is very accurate and provides standard technical information about medical imprints, both by author and subject. It is to be regretted that he did not study a larger area, or one with earlier printing, so that his talents might have been more fully utilized.

Peru

Gabriel Réné-Moreno (1836-1908) is known for his *Biblioteca Boliviana,* though for medical imprints a more important work is his *Biblioteca Peruana* (Santiago de Chile, 1896), which appeared in two volumes with descriptions of the books printed in Peru.

José T. Medina published a work on *La Imprenta en Lima (1584-1824)* (Santiago de Chile, 1904-1907) in four folio volumes, which is the standard record of printing in a city second only to Mexico for quantity and quality of imprints. Medina covered this area thoroughly, and it is difficult to find any medical imprints to add to those he described so accurately.

Hermilio Valdizán (1885-1929) was born in Huánuco, near Lima. He was of humble Basque extraction and had to support his studies in the medical school of the University of Lima by working as a reporter for local newspapers. In 1909 he was graduated and departed for Italy, where he worked in psychiatry under Sante de Sanctis, Ciampi, and Cerletti. Upon Valdizán's return to Lima in 1914 his flair for journalism induced him to start publication of several medical magazines, the *Anales* of the medical school, a journal of psychiatry, and a magazine devoted to the history of medicine called *Unánue.* Like Lastres, the other great historian of medicine in Peru, Valdizán became professor of psychiatry and went into private practice. Both men produced historical accounts of Peruvian medicine, but among Valdizán's many works on medicine the one most interesting to bibliographers is *Apuntes para la Bibliografía Médica Peruana* (Lima, 1928). This work covers Peruvian medical imprints of the seventeenth and eighteenth centuries, starting with the work of Dávalos y Figueroa, printed in Lima in 1602, and finishing with the imprints of 1800. The material was taken entirely from Medina, some entries being expanded with medical articles which appeared in *El Diario de Lima* and the *Mercurio Peruano.* This record includes 23 items for the seventeenth century, and 350 more for the eighteenth

century, as well as 50 additions, notes, and appendices. Valdizán's book is a reference work for the historian and for the physician, but as soon as he forsakes the guidance of Medina, the material is unbalanced and disorganized. His influence in Peru was great, and it was said that he fostered a love for books, cured the sick, and planted roses—interests which are indicative of the humanistic values which characterized his life.

BRAZIL

Inocencio Francisco da Silva (1810-1876) was born in Lisbon and studied the humanities, although most of his studies were self-directed. His liberal beliefs brought political difficulties both in his career as a civil servant and as a teacher. Despite limited means da Silva was a great book collector and gathered a good library, which is known through the printed catalogue. As a bibliographer da Silva was able to extend to a considerable degree Barbosa Machado's early studies of Brazil. His major contribution was a *Dicionário Bibliográfico Portugués,* printing of which was begun in Lisbon in 1858. After his death the work was taken up by Brito Aranha, and the final volume, the twenty-second, was completed in 1919. Inocencio, as most writers call him, is important to medical bibliography because he recorded Portuguese authors who wrote on American medical topics and above all because he provided information about the lives and works of most of the early medical authors of Brazil, giving fairly accurate transcriptions of titles and dates.

Alfredo do Valle Cabral (1851-1894) was to Brazil what García Icazbalceta was to Mexico. Working through the records of the first printing shop of Brazil—the Imprensa Nacional of Rio de Janeiro—Valle Cabral was able to trace most of the issues between the establishment of the press in 1808 to the independence of Brazil in 1822. In his *Annaes de Imprensa Nacional do Rio de Janeiro de 1808 a 1822* (Rio de Janeiro, 1881) he gave good descriptions of Brazil's earliest medical imprints. The *Suplemento* produced by *José Honorio Rodrigues* in 1954 does not affect the quality of Valle Cabral's coverage, and his work remains the standard reference for early printing in Brazil.

José Carlos Rodrigues (1844-1922) was a journalist who gathered together one of the largest collections of books printed in or related to Brazil. Born in Rio de Janeiro, he went to New

York, where he was editor of a Brazilian journal *O Novo Mundo* from 1870 to 1879. He then returned to Rio de Janeiro and there directed the *Jornal do Commercio*. The catalogue of his library, *Catalogo . . . Brasil Colonial 1492-1822* (Rio de Janeiro, 1907) records many Brazilian medical imprints of that period.

Rubens Borba de Moraes' (1899-) work, *Bibliographia Brasiliana* (Rio de Janeiro, 1958), is important as supporting material for the history of medicine in Brazil and for the record of books relating to medicine in Brazil.

The Author was unable to find any publication relating to early medical printing in Brazil as a whole for his 1950 survey of American medical imprints of Colonial Spanish America. After research at Rio de Janeiro and elsewhere, he published a *Bibliografia Medica Brasileira, Periodo Colonial, 1808-1821* (New Haven, 1958) in which 55 imprints are described. This work, in Portuguese, supplies some biographical information about the authors, and gives the title, bibliographical description with locations and references, and facsimile reproductions of some title-pages. The research was made easier by Valle Cabral's survey of printing at Rio de Janeiro, but the medical imprints of Bahia were found only with difficulty, because of the lack of prior systematic bibliographies outside the area of Rio de Janeiro.

Chile

Benjamin Vicuña Mackenna (1831-1886) was the first bibliographer of Chile to devote some attention to medical matters. He was born in Santiago de Chile and was obliged to leave his country in 1851 because of some political harassment, going first to California and then to Europe. In exile he began collecting documents on the literary and political history of Chile. On his return home, Vicuña was graduated in law at the University of Santiago in 1857 but was soon exiled again, this time in Spain, where he remained from 1858 to 1863. He wrote *Los Médicos de antaño en el Reino de Chile* (Santiago de Chile, 1877) in addition to several bibliographical studies which were not always remarkable for their accuracy.

Luis Montt Montt (1848-1909) published a *Bibliografía Chilena* (Santiago de Chile, 1904), recording Chilean imprints up to 1817; some medical titles are to be found among them.

José T. Medina covered the same period as did Montt and published a *Bibliografía de la Imprenta an Santiago de Chile* (Santiago de Chile, 1891); his additions and corrections were not printed until 1939. The final result is the best bibliographical guide to the early medical imprints in Chile to the year 1817.

ARGENTINA

Juan Maria Gutierrez (1809-1878) started a systematic survey of Argentina's imprints in his *Bibliografía de la Primera Imprenta en Buenos Aires* (Buenos Aires, 1866) and recorded 215 imprints, some of which pertained to medicine. *Antonio Zinny* (1821-1890) provided some additions to this work and published them in his *Bibliografía Histórica . . . del Río de la Plata* (Buenos Aires, 1875). *José T. Medina,* in his *Historia y Bibliografía de la Imprenta en el antiguo Virreinato del Río de la Plata* (Buenos Aires, 1892), recorded 851 imprints and included the early broadsides of the Protomedicate in the eighteenth century.

Guillermo Furlong Cardiff (1889-) was born in Villa Constitución, Argentina, studied at Georgetown University from 1910 to 1914, and was graduated in philosophy. He afterwards entered the Society of Jesus and went to the Colegio Máximo of Sarriá near Barcelona, Spain, and remained there from 1920 to 1925, when he began teaching English and literature at the Colegio del Salvador, S.J., in Buenos Aires, pursuing at the same time research into the bibliographical history of the River Plate territory and of printing by Jesuit missions among the Guaraní Indians. Father Furlong has made important contributions to medical history and to biobibliography in Argentina, particularly by his book on *Médicos Argentinos durante la dominación española* (Buenos Aires, 1947), which was complemented by a similar work on *Naturalistas Argentinos durante la dominación española* (Buenos Aires, 1948). His library, preserved at the Colegio del San Salvador, was the starting point for his *Historia y Bibliografía de las primeras imprentas Rioplatenses* (Buenos Aires, 1953-1955) in which he confirmed most of the pioneer findings of Medina in 1892. It is an extraordinary experience to work with Father Furlong in his excellent library and to listen to his keen suggestions of how the medical history of the area, which is somewhat poor in medical imprints, may be studied through important manuscripts pertaining to the materia medica of the Missions during the eighteenth century.

José Luis Molinari (1898-) was born in Buenos Aires and was graduated from the Medical School there in 1927. Although he is a professor and practising physician specializing in radiology, his literary production in the fields of numismatics and political and medical history is considerable. Many of his minor publications touch on the subject of medical history of the Vice-Royalty of the River Plate, and his compact *Historia de la Medicina Argentina* (Buenos Aires, 1937) is excellent. In the field of bibliography, Molinari is the author of the only systematic medical bibliography of the colonial period in Argentina, which appeared under the title, *Primeros Impresos Médicos Bonaerenses (1780-1810)* (Buenos Aires, 1941). This work supplies exact descriptions of every broadside and pamphlet, with facsimile reproductions of title-pages, which in some instances are from copies in Professor Molinari's private collection.

Summary

The bibliography of early Americana comprises a group of authors, such as Trelles, León, and Valdizán, who published complete records of the first centuries of medical printing in various areas of the New World. Certain works afford not only good bibliographical descriptions but also analyses of medicine from the historical viewpoint. In this respect those bibliographies which are organized in chronological order are of greater practical use to the historian and are therefore of more permanent value. The colossal work of Medina, despite the years which have elapsed since its publication, has remained the standard reference for research and the starting point of future contributions for those dealing with Spanish America. There are already bibliographical studies of early medical imprints for most geographical areas, though there are a few areas where the regional surveys have been rather weak, and in these cases the researcher must either resign himself to the guidance of general bibliographies or must do without them. Medical bibliography in such instances must be based not only on good planning and a combination of approaches but must be supported by unusual stamina, in order to screen and analyze large quantities of printed material. This is but to confirm Gesner's comment on embarking on medical bibliography—that in the bibliographer's home the midnight oil must be continually burning.

James Mackenzie and Pain

KENNETH D. KEELE*

THE physiologist and the physician have always seen the problem of pain from opposite sides. The physiologist sees it as manifested in the experimental animal, rarely a human being; the clinician sees it as a human problem in disease, mental or physical. Only in this century have these two points of view begun to find points of contact. John Fulton was well aware of this gap between physiologist and clinician. His life-long sensitive human sympathy bridged the hiatus, and well I remember his saying how difficult he had found it early in his career to decide on a clinical or a physiological approach to medical problems. This clinical attitude penetrated into his laboratory, to the very chimpanzees to which he always referred in terms of affection. It was quite evident that "Yama" was to him a patient, to be coaxed, managed, and observed. Hebbel Hoff noted this clinical color to John Fulton's researches when he wrote, "His laboratory of physiology was notable for its humanistic approach. John perhaps should have been a surgeon so that he could savor some of the satisfaction that comes from direct intervention for the benefit of a patient. Careful observation of behavior, close examination by the unaided senses and a minimum of instrumentation were emphasized as the fundamentals of all good research."[1] To which remark James Mackenzie would have added—"and of all good clinical practice too."

On the other hand, if we may ask how so clinically gifted a man as John Fulton became a research physiologist, we may also ask how James Mackenzie with his great gifts for research became a clinician. How did this general practitioner with little means and negligible facilities, embark on cardiovascular and neurological studies which achieved results of such lasting value? This is a question that concerns both clinician and research worker, for in the answer lies the enrichment of the task of each. One thing is clear: Mackenzie convincingly demonstrated that the so-called dullness of general practice lies more in the practitioner than in the practice. This article is therefore as much an attempt to sketch

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[1] Hoff, H. E. The laboratory of physiology. John Farquhar Fulton Number, *Yale J. Biol. Med.*, 1955-1956, *28*, 166.

Mackenzie's outlook as to explain the work on pain to which he devoted so much of his life.

Mackenzie was not one of those with a so-called vocation for medicine from early childhood. Born in 1853 at Pickstonhill, a few miles from Perth, his first contacts with life were in the countryside. Raised on a farm, like another Scot, John Hunter, Mackenzie did not take well to the books of academic Scottish education. "I was considered a dunce at most of my classes," he said, "and the subjects in which I did well were those in which my understanding, rather than my memory, was called into play." Pain rapidly entered into the life of a "dunce" at the Perth Academy. One day, late for school on account of the snow and ice, he was given a "palmy." "The cane hit right across the end of my half-frozen thumb, and the agony remains in my mind as the severest pain I ever experienced."[2]

Leaving school early, Mackenzie became, for no very clear reason, a chemist's assistant in a drugstore in Perth. During these five years of monotonous routine, the contact with doctors' prescriptions opened to him the horizon of medicine as a possible profession. At the age of 20 he went to Edinburgh to join his younger brother, then studying for the church.

Again Mackenzie's unacademic mind stumbled over the academic requirements of pre-clinical examinations, but when he reached the clinical stages, he found himself winning medals. Thus he reached his goal of qualification without relinquishing his opinions on the defects of education in general and of medicine in particular. Why, he asked, do all the prizes in education go to those who can memorize rather than those who can think?

When Mackenzie was graduated in 1878, the bacteriological era was coming into full spate. Pasteur had demonstrated its possible importance. Lister at Edinburgh had espoused it and was applying it to the practice of surgery. For one who was going to become a great investigator in medicine, it would seem inevitable that the germ theory of disease would provide the problem. But Mackenzie's work is notable for the almost complete absence of any reference to the medical theme of his day, bacteriology, except a remark on its deficiencies in providing adequate causal conceptions of disease.

Besides his unacademic attitude there was one other negative feature of Mackenzie's outlook: he was completely ignorant of

2 Wilson, R. M. *The beloved physician*. London, 1926, p. 11.

medical history. He tried to solve his perplexities by turning to the encyclopaedic medical works of his day, but these merely repeated those didactic lessons of academic medicine which he had already found deficient. Had he turned to the history of medicine, he would have found his views on symptoms and prognosis sympathetically considered as long ago as Hippocrates.

As it was, his entry into general practice had the effect of a cold douche on the medical side of his nature. For he found that as a practising doctor he was dealing with problems for which he had not been educated. The experience shocked and surprised him. He set out to define this unexpected difference by studying his practising colleagues as well as his patients.

In 1879 Mackenzie went from a house appointment at the Edinburgh Royal Infirmary to an assistantship in the practice of Dr. Briggs and Dr. Brown in Burnley. In a room on the top floor of 68 Bank Parade Mackenzie first came to grapple with the problems of medical knowledge. He noted how the senior partner of the firm, Dr. Briggs, made subconsciously accurate prognoses from the "face of the disease"; he considered how such "clinical sense" was built up from past experience and what the nature of that past experience was which gave a good practitioner this power of prognosis. He also made careful note of the presenting symptoms of patients and found that they did not correspond with the clinical classifications laid out in his medical textbooks. He realized that he did not understand such symptoms as pain and palpitation of the heart. At first he thought this ignorance only personal, but after some years he came to realize that it extended throughout the medical world. And so at long last this man with the power of thought discovered the gap through which he could and would exert this intellectul power. Mackenzie describes this phase thus:

> For some years I went blundering on, gradually falling into a routine, i.e. giving some drug that seemed to act favourably upon the patient, until I became dissatisfied with my work, and resolved to try and improve my knowledge by more careful observation. I could not for a long time think of any definite scheme, and I tried first one way and then another. . . [Finally] I put to myself the question, "Do I understand the meaning of one single sign or symptom in all its aspects, for example, the mechanism of its production, or the bearing of its cause upon the patient's future health?" In this way I was brought to a realisation of the fact that I did not understand the full meaning and significance of a single symptom. It was about 1883, I think, that this idea occurred to me, and at the time I had no thought of undertaking what may be called research.[3]

[3] Mackenzie, J. *The future of medicine.* London, 1919, p. 62

J. F. with Yama, one of his favorite "patients." (Photograph by Dr. Richard U. Light, 1933.)

Birthplace of Sir James Mackenzie (from a kodacolor print taken by K. D. K., 1961).

Thus Mackenzie embarked on a crusade to comprehend the mechanism and prognostic significance of his patient's symptoms. He soon became overwhelmed by the magnitude of his task, yet the conviction of the importance of symptoms grew with his experience of medical practice. The early evidence of disease is most often symptomatic alone. The first evidence of a breakdown of harmony between a person and his environment is in the production of a symptom. But such symptoms were considered trivial:

> It is not only assumed that the matter is easy to investigate, it is also taken for granted that the information is usually of little value when obtained, partly because other means of inquiry are more precise and other signs can be more easily demonstrated, and partly because the patient's description is coloured by his own individuality, and thus either exaggerated or rendered too vague and indefinite to be of use. When all this is recognized there is still a great field of useful information to be acquired.[4]

It soon became obvious to Mackenzie that he must define and limit this vast field. How? The answer came in part through his own distress at the death in childbirth of a young woman with mitral stenosis. A study of the literature showed little knowledge of the prognosis of pregnancy in patients with heart disease. Noticing that cardiac irregularity was very common, he set out to find the significance in general of an irregular heart. At this time there was no differentiation of one type of cardiac irregularity from another, so it became a focus of Mackenzie's attention. First he set out to differentiate the mechanisms underlying the symptom "cardiac irregularity," then to observe patients over long periods of many years to substantiate the prognostic significance of each of the various forms of irregularity. Thus it took Mackenzie 20 years of patient observation to establish that the "irregularity of youth," now known as sinus arrhythmia, was a phenomenon of health, not disease, and that confining children with this irregularity to bed for months, as was the practice of the day, rested on ignorance of the mechanism and prognosis of a simple, common symptom. Thus, one of the most important results of Mackenzie's methods was quietly and quickly inserted into medical textbooks, "as if," writes Mackenzie,

> they were matters so well known that it is unnecessary for the author to indicate whence he got his knowledge, or how the knowledge was obtained. I do not doubt he would say it was learned from his own experience, and would not admit that it was borrowed from me, or recognise at what expense of time and trouble it had been acquired. It took me

[4] *Ibid.*, p. 64.

fifteen to twenty years of patient observation, and it required the collection of an enormous number of records before I felt confident in the soundness of this prognosis.[5]

It was thus that Mackenzie entered the path of analysis of cardiac irregularities; thus he saw the need to analyze the synchronous action of atria and ventricles in cardiac irregularities; and thus he developed the polygraph for this purpose, with the result that he separated out the main forms of cardiac irregularity which are recognized today—and defined their prognostic significance.

But he never ceased to stress that the significance of any cardiac symptom was its relation to the onset of heart failure; and as symptoms of heart failure he emphasized breathlessness and pain. Thus in the syndrome of angina pectoris, from which he himself eventually suffered, there was a convergence of his interest in the mechanism and significance of the symptom pain and the prognosis of heart disease.

Mackenzie's studies on pain had been running parallel to those on heart disease since his early days in Burnley. He found, as all clinicians have found, great difficulties in eliciting accurate information about the symptom—difficulties of location, of memory, and of verbal description. He minimized these as far as possible by himself observing the patients whilst in pain, noting all associated phenomena, in particular the shift and radiation of pain from the original site. Mackenzie emphasized the difficulties in observations on pain.

Clinical medicine has not yet formulated definite ideas as to how to start the inquiry upon this subject. I have shown that before he can acquire the skill necessary to obtain from patients such descriptions of their sensations as will enable him to recognise the nature of their complaints it is necessary for the physician to undergo a long preliminary training. Much as it may surprise you to hear it, the same training is necessary before the physician is competent to investigate the seat of the pain, and to estimate the full meaning of the sign. The intelligent examination of the patient, revealing the exact site of the pain, the occasion of its appearance, the manner of its radiation, the way in which it subsides, affords an insight into the constitution of the nervous system the extent of which even neurologists little realise."[6]

Thus he collected many clinical observations; but he was still "like a ship at sea without compass" when, in 1889, James Ross

[5] Mackenzie, J. *Diseases of the heart.* Oxford, 1925, p. 19.
[6] Mackenzie, J. *Principles of diagnosis and treatment in heart affections.* London, 1916, p. 126.

of Manchester published his paper in *Brain*[7] propounding the hypothesis that visceral pain was of two kinds: one, "splanchnic," referred to the viscus of origin, the other, "somatic," referred to definite areas on the external body wall. "I do not recollect any article which was to me of so much help,"[8] writes Mackenzie. The reference of visceral pain to the body wall via the spinal cord was a suggestion not original with Ross. In 1864 Martyn had noted the segmental distribution of left mammary pain and considered that anatomical nervous connections between the heart and the region of inframammary pain might account for this location by central reference; and Sturge in 1883 noticed similar distribution, going as far as to postulate "an abnormal commotion in the grey matter" of the spinal cord to account for such reference.

Mackenzie, testing Ross's hypothesis, immediately made observations which he found incompatible with it—observations which are, incidentally, still disputed. Mackenzie was satisfied that pain felt at a distance from an organ which was its source, was indeed referred. But he was not satisfied that pain felt in the region of such an organ was felt in that organ and not in the body-wall overlying it. For example, is the pain of gastric ulcer felt in the stomach, or in the epigastric part of the abdominal wall?

> I discussed the matter with Ross [writes Mackenzie] and he maintained his view, and mentioned a case of gastric ulcer in whom the pain in the epigastrium was severe and limited to so small an area that he felt certain if he pushed a long needle through this area he would penetrate the ulcer. I pointed out that if the patient took a deep breath the stomach and the ulcer would be shifted, but would the site of the pain shift. Putting this to the test, I found the pain did not shift.[9]

This suspicion of the absence of location of pain in viscera which arose in Mackenzie's mind was strengthened by Lennander's systematic testing of the abdominal viscera for sensitivity at operation, using local anaesthesia. From these observations Lennander concluded that the abdominal viscera were insensitive to cutting, burning, or pricking, but that the parietal peritoneum and the roots of the mesentery were sensitive.

Mackenzie himself set out to repeat the experiments of Haller on the sensitivity of the various tissues. He noted the great variation of pain-sensitivity in different regions of the skin and deeper tissues and the insensitivity of viscera to stimuli that pro-

[7] Ross, James. On the segmental distribution of sensory disorders. *Brain*, 1888, *10*, 333-361.
[8] Mackenzie, J. *Op. cit.* (note 3), p. 67.
[9] *Ibid.*, p. 68.

duce pain in the body wall. He linked sensitivity to pain from pricking and burning and similar causes to the cerebrospinal nervous system, and insensitivity to these stimuli to sole supply by the autonomic nervous system.

An observation to which he attached great importance was that of a man with severe gallstone colic. When this had subsided, the patient developed hyperalgesia of the skin over his right lower chest and hypochondrium. In addition, he had to breathe quietly to prevent pain. This led Mackenzie to investigate hyperalgesia of the skin, which he found commonly present in visceral disease. Again he had found evidence that Ross's splanchnic pain was in fact referred pain arising in the same way as hyperalgesic skin. On further studying this hyperalgesia, he found it to be of different kinds. Superficial cutaneous hyperalgesia was detectable by scratching the skin with a pin, and deep cutaneous hyperalgesia was elicted by pinching the skin. This hyperalgesia he found to extend into the deeper layers of the abdominal wall, the most important of which are the muscles. Here it was accompanied by segmental areas of contraction or rigidity. Thus he reached the conclusion that two distinct reflexes exerted their effects on the body wall in the presence of visceral disease, the viscero-sensory reflex shown by pain and hyperalgesia or tenderness, and the viscero-motor reflex shown by muscular contraction. These reflexes are both mediated by stimuli passing to the spinal cord, to sensory and motor centers, whence they are reflected to the corresponding area on the body wall.

What is the mechanism of pain produced by stimulation of cerebrospinal nerves? In Mackenzie's view there are good grounds for assuming special nerves for the conduction of pain with special peripheral receptor organs, the conduction of such stimuli passing into the spinal cord by posterior spinal roots. He noted that painful stimulation of the skin not only conveys the consciousness of pain but locates the stimulus with more or less accuracy. In the course of its passage from the skin to the brain the nerve may be subjected to stimulation. Such stimulation will be felt not at the place stimulated but in the field of peripheral distribution of the nerve. He noted from clinical observation how pressure on the posterior nerve root ganglia from tumor, or in a disease like herpes zoster, gives rise to pain referred to the peripheral distribution of the affected nerve, the reason being that "every nerve gives rise to its peculiar function. If it be the optic nerve then it

gives rise to a sensation of light; if it be the auditory nerve then to the sensation of sound; if it be a pain nerve then to the sensation of pain referred to the peripheral distribution of the nerve."[10]

In this part of his work Mackenzie worked in close contact with Sherrington whose views and experiments he frequently cites. In relation to the radiation of pain he here quotes "a striking instance recorded by Professor Sherrington. He states that 'by applying a mustard leaf over the upper part of the sternum I can produce in myself the sensation of a patch of unpleasant tingling character referred to the inner side of each upper arm, just above the inner condyle.'" The same stimulation, notes Mackenzie,

> produced the pain in widely separated parts. If we inquire into the nerve supply the matter becomes clear. The second thoracic nerve supplies the skin of the upper part of the chest and the inner side of the upper arm. While the peripheral ends of the nerves supplying the upper part of the chest and inner side of the upper arm are widely apart, their centres in the spinal cord are intimately associated, so that when a violent stimulus from the periphery reaches the spinal cord it affects the nerve cells in its neighbourhood, which in this case happen to be those supplying the upper arm, and they react according to their nature, and give rise to pain referred to their peripheral distribution.[11]

Thus the study of the mechanism of pain led Mackenzie to formulate his concept of the "irritable focus" in the spinal cord, by which he accounted not only for its localization on the surface of the body but also for associated phenomena such as rigidity of the muscles of the abdomen, hyperalgesia, and tenderness. For if, in his view, stimuli pass from a diseased part into the spinal cord, they will meet neurones supplying the muscles, blood vessels, and secretory glands. Such nerve cells will react in their own specific fashion, the sensory neurone producing pain, the motor neurone muscle contraction, the secretory neurone glandular secretion. This concept he illustrates in a simple diagram (Fig. 1).

The concept of the irritable focus in the spinal cord produced a method for plotting areas of reference on the body surface. These were correlated with known areas of eruption in such conditions as herpes zoster, which Head and Campbell had shown to be a disease of the posterior root ganglia. Mapping of the dermatomes of the body by the method of "remaining sensibility" used by Sherrington and Foerster showed remarkable conformity. Thus the basically segmental pattern of sensory nerve distribution began

10 Mackenzie, J. *Symptoms and their interpretation.* 3d ed. London, 1918, p. 29.
11 *Ibid.*, p. 89.

to become clear in relation to the reference of visceral pain. Mackenzie used a diagram of the amphioxus from Ross's work to illustrate this pattern in relation to pain arising from the heart (Fig. 2).

The nature of the adequate stimulus for visceral pain still presented its challenge—and one that Mackenzie found it difficult to meet. In the great majority of his observations visceral pain was produced by the contraction of smooth muscle, intestinal, uterine, ureteric—the colics. The relationship of pain to contraction in hollow muscular organs was proved by a crucial observation Mackenzie made at an operation. The patient concerned had to have a resection of a portion of intestine without an anaesthetic.

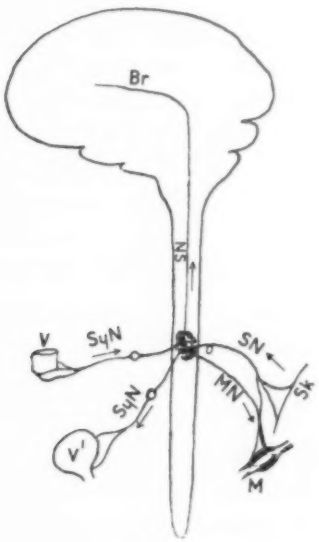

FIG. 1. Diagram to represent the mechanism of visceral pain, cutaneous and muscular hyperalgesia (viscero-sensory reflex), the viscero-motor reflex, and the organic reflex. An adequate stimulus proceeding from the organ, V, by the sympathetic nerve, SyN, to the centre in the spinal cord extends to the cells of nerves in its neighborhood, and stimulates them to activity, when the function peculiar to each nerve is exhibited. Thus the stimulus affecting the cells of a pain nerve, SN, results in the perception of pain which is referred by the brain to the peripheral distribution of the nerve in the external body wall (Sk,M.); affecting the cell of a motor nerve, MN, causes a contraction of the muscle, M, supplied by the motor nerve; affecting the cells supplying other viscera as (V) stimulates them to their peculiar function (contraction of a hollow muscular viscus, increased secretion of a secretory organ). If the stimulus be of sufficient strength it may leave an irritable focus in the spinal cord (shaded area) as shown by a persistent hyperalgesia of skin and muscle (Sk,M) and by a persistent contraction of the muscle (M). (From *Symptoms and their interpretation* by Sir James Mackenzie, 1918, p. 87).

While the abdominal organs were exposed I tested their sensibility, and cut and stitched the bowel, and no sensation was produced. I had prepared the upper portion of the bowel and wrapped it in a warm sterilised cloth and laid it on one side. I noted that the patient occasionally groaned as if in pain, and I asked him if he suffered, and he said that every now and again he felt a severe griping pain. On looking for a cause I observed that about a foot of the lower end of the upper portion of the cut bowel passed into peristalsis each time the patient groaned. By pinching the bowel I could start the peristalsis, and the wide flaccid bowel would contract into a thick fleshy rod. Each time this happened the pain was felt, and on asking him where it was felt, he indicated the umbilical region. Here before my eyes was the undoubted cause of the pain, situated some distance away from the place where the pain was felt.[12]

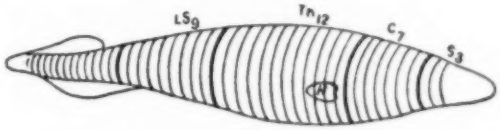

FIG. 2. Diagrammatic representation of a primitive vertebrate animal —the Amphioxus—divided for convenience into three segments for the head, seven for the neck, twelve for the thorax, nine for the lumbo-sacral region, and an adequate number for the coccygeal region. For clearness of comparison the heart (H) is represented as occupying the same position as in man, so that an adequate stimulus from the heart would cause pain in the distribution of the four upper thoracic nerves covering and protecting the heart. (After Ross. From *Symptoms and their interpretation* by Sir James Mackenzie, 1918, p. 94).

Thus contraction of smooth muscle in Mackenzie's view provides the adequate stimulus of visceral pain. He could find no other—all forms of mechanical stimulations of the viscera such as burning, cutting, and violent tension being in his experience inadequate. He was impressed, however, with states primarily affecting the spinal cord in the production of visceral pain: for in his view anything exciting the reflex viscero-sensory area was capable of exciting pain. He pointed out how, in a patient with pain from gallstone colic which had subsided leaving hyperalgesia, food taken into the stomach reproduced the pain, which disappeared when the hyperalgesia disappeared. Another way in which the irritable focus in the cord can be stimulated is by the "startle" reaction. As an example of this he cites the case of a lady with endometritis and sacral pain with tenderness and stiffness of the lumbar muscles, in whom pain would appear suddenly if she were startled by the banging of a door. Thus once the

12 Mackenzie, J. *Op. cit.* (note 3), p. 78.

irritable focus is formed in the spinal cord, normally non-painful stimuli can become adequate stimuli for pain.

Mackenzie thus returned to the consideration of anginal pain. Here, though a muscle was involved, it was not one which could undergo violent contraction as in the colics of intestine and uterus —the heart did not pass into any contraction resembling peristalsis when cardiac pain was present. What then was its mechanism?

If cardiac pain is not produced by intense muscular contraction it must be produced by summation of stimuli, i.e., it must be produced by a series of beats, the same kind of stimulus that a strong colicky contraction produces in other hollow muscular organs. This view Mackenzie put to Sherrington, who replied,

> I have been thinking over your argument. I believe it is exactly right. Further points in its favour, in my view, are that summation is a factor pre-eminently potent in production of most pains, and I expect of all pains. For instance, a single induction shock to the skin that is not intense enough to cause pain, becomes on repetition unbearable by summation. . . . Hence the tight hat or tight shoe is hardly noticeable as being tight at first, but they soon become unbearable by summation.[13]

Mackenzie recognized that cardiac ischemia played a part in angina: "the pain of angina pectoris is associated with muscle contraction, and a stimulus adequate to cause the pain in angina pectoris is muscle contraction when there is a deficient blood supply to the heart muscle."[14] But in his view this was only one factor, for he found patients with coronary disease without angina; and patients with angina without coronary disease. He emphasizes in this connection that there are two main factors concerned in the production of pain: "the strength of the stimulus and the susceptibility of the nervous system." It is for this reason that the intensity of pain is not related to the gravity of the disease. Thus he divided "primary" angina, where the pain arises in heart muscle, from "secondary" angina, where it arises from hypersensitivity of the nervous system, either localized in an "irritable focus" in the spinal cord or more generalized in the state called "neurasthenia." Mackenzie is emphatic that "hypersensitivity" either of cell, organ, or individual is as important a factor in the production of pain as a noxious stimulus. This sensitivity, he points out, may be grossly varied by toxic or chemical influences, by mental states, by chronic disease, and by long-lasting pain itself.

Throughout his life Mackenzie expressed a strong urge to integrate his observations and ideas into an all-embracing theory.

[13] *Ibid.*, p. 89.
[14] Mackenzie, J. *Angina pectoris.* London, 1923, p. 41.

Toward the end, while working as a consultant in Harley Street, he reaped the harvest of recognition but he found his views so misunderstood in London, even by his friends, that in 1918 he retired to St. Andrews in Scotland to make a final onslaught on the subject of symptoms. Here, in relative isolation, he gathered in the local practitioners and members of the medical faculty of this ancient University and created an Institute for Clinical Research. At the first general meeting of the Institute in September 1919, its program was outlined: "The main objects of research would be the early stages of disease, and the work would primarily consist of detailed observation of symptoms and the keeping of careful records. Prolonged observations of cases would be carried out in order to discover the significance of early symptoms, and researches would be undertaken with a view to ascertaining the mechanism of their production."[15]

For over six years, suffering all the while from angina pectoris of disabling severity, Mackenzie strove to find a classification of symptoms. This he produced in a small work of 107 pages in which he concentrated the essence of his views on pain and other symptoms. *The Basis of Vital Activity* contains a summary of Mackenzie's life work. He reaches his classification of symptoms through a study of the activities of the cell as illustrated by the Sundew (Drosera rotundifolia):

> In the vegetable and lower animal kingdom, [he writes] there are to be found a number of organs of a character which renders them suitable as subjects of study by those anxious to investigate the nature of the cell impulse. Among these are the plants the leaves of which show signs of movement, and the sponges. One of the simplest of these organs is the hair on the leaves of the Sundew. This hair when an appropriate stimulus is applied, such as a fly alighting upon the leaf, bends down until its points or tips rest on the fly.[16]

From this surprising, though typically imaginative starting point, Mackenzie elaborates the meaning of "stimulation," "conduction," and "contraction" in living organisms, as equally applicable to the complexities of man as to the simple Sundew.

On this basis he classified symptoms as follows:

> All forms of vital activity are due to the functioning of living cells. Living cells are never at rest; they are either discharging energy or renewing it. Modifications of all activity can only be brought about by hastening or delaying the renewal of energy. When cells are grouped to form an organ their activity is regulated and controlled. Cells in discharging

[15] Quoted from Wilson, *op. cit.* (note 2), p. 276.
[16] Mackenzie, J. *The basis of vital activity.* London, 1926, p. 50.

energy exhibit their peculiar function (e.g., contraction, secretion, sensation) and at the same time discharge an impulse. This impulse exerts an influence on neighbouring cells by increasing or delaying their period of renewal of energy. Certain cells exercise a controlling influence upon other cells. The functional activity of organs is reflected and controlled by structures other than their own cells. These other structures with the 'effector organ' constitute the elements of a reflex arc. Symptoms are due to a disturbance of some element of the reflex arc. Such disturbances result in (1) an increase in the number of impulses reaching the effector organ, or (2) a decrease in the number of these impulses, or (3) an interference with the generation or conduction of impulses.[17]

This succinct and concentrated effort towards simplification is typical of Mackenzie's thinking. He proceeds to apply it to the genesis of cardiac arrhythmias, to the constitution of the central nervous system, and so to symptoms as diverse as spasticity, paralysis, and migraine. Finally he integrates into it the phenomena of tenderness, hyperalgesia, and pain. The steps of his argument cannot with justice to him be more brief than he himself has made them in this short book. They cover many points which have already been mentioned in this paper.

With regard to his achievement Mackenzie was modest.

Pain is perhaps the commonest of all symptoms. Yet our knowledge of its inception is still in an extremely unsatisfactory state, and constitutes a striking indication of the imperfection of modern methods of investigation. . . . The doctor must know and know about the structures which generate impulses if he is ever to discover the source of pain. At present—I say it without hesitation—he does not know about these structures. Nor does he know why or how the so-called 'pain' impulses differ (if indeed they do differ at all) from other impulses.[18]

These words stand as a challenge to physicians and physiologists today.

Mackenzie himself, it will be noted, worked closely with his friend and colleague, Charles Sherrington, to whom he constantly turned for physiological aid in the interpretation of his findings. In this close liaison between experimental physiologist and clinician Mackenzie perhaps blazed a trail for fruitful discovery in medicine. It was a trail which, in the treatment of pain, led through Sherrington to his pupil John Fulton, and so to the procedure of leucotomy, today so intimately concerned with the relief of human suffering. Indeed, if we look for the link between the clinical physiologist, John Fulton, and the research physician, James Mackenzie, we find it in the name of Charles Sherrington.

17 *Ibid.*, p. 65.
18 *Ibid.*, p. 40.

"Airs, Waters, and Places" in History*

GENEVIEVE MILLER**

THE conviction that man's external environment has some direct influence on his physical constitution and health probably began in that moment when men ceased to believe in supernatural causation and understood that causes lie within nature itself. It is a universal human experience that personal comfort and moods are modified by weather changes, that howling winds create irritation or uneasiness, and certainly the familiar statement "It isn't the heat, it's the humidity" needs no amplification. Travellers to different climates often observe modifications of normal physiological functions which do not seem to be related to a change of diet or habits. It is also obvious that the recurring rhythm of living nature coincides with the recurring changes of season.

The first attempts of which records have been preserved to give rational explanations for such phenomena were made by pre-Socratic Greek philosophers. Around 500 B.C. environmental factors such as water and location were included by Alcmaeon of Croton in his definition of health and disease:

> Health is the equality of rights of the functions, wet-dry, cold-hot, bitter-sweet and the rest; but single rule among them causes disease; the single rule of either pair is deleterious. Disease occurs sometimes from an internal cause such as excess of heat or cold, sometimes from an external cause such as excess or deficiency of food, sometimes in a certain part, such as blood, marrow or brain; but these parts also are sometimes affected by external causes, such as certain waters or a particular site or fatigue or constraint or similar reasons. But health is the harmonious mixture of the qualities.[1]

Democritus of Abdera, a contemporary of Hippocrates, compiled a weather calendar for northern Greece, indicating time by the rising and setting of certain stars, which in turn were associated with changes of season and of weather.[2]

The first complete statement about the influence of seasonal and environmental factors on health is found in the Hippocratic treatise

* Dr. John F. Fulton presided over the session of the History of Science Society's annual meeting in New York on 29 December, 1956 at which this paper was first presented. It is dedicated with respect, affection, and gratitude to his memory.

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[1] Kathleen Freeman, *Ancilla to the pre-Socratic philosophers.* Oxford, 1948, pp. 40-41.

[2] *Ibid.*, pp. 94-96.

"Airs, Waters, and Places" which, Edelstein maintains, was written as a prognostic guide for a physician who came to a new locality.[3] By acquainting himself with details such as the position of the site with reference to the sun, the soil, elevation, prevailing winds, and the nature of the water supply, the physician could predict the character of the population and its diseases. The second part of the treatise, which some have argued is actually a separate work,[4] is an exposition of the influence of climatic and geographical factors on the physical and moral constitutions of various nations of Europe and Asia. The purpose of the present discussion is to sketch the reception which the ideas embodied in the first half of this treatise have had during the past three hundred years. The commentators on this document of ancient thought provide an interesting spectacle of the attempt to accommodate new facts to old ideas.

If one should ask a physician today to comment on the treatise from the point of view of current knowledge and practice, he would label it an antiquated document based upon philosophical presuppositions which modern science has rendered invalid. He would probably be annoyed with its schematic nature, by the forcing of observational data into a preconceived pattern, by the lack of proof for any of the statements, and he would fail to find many observations which correlate with his own experience. The treatise would be of no use to him in his own medical practice, and he would probably wonder how it could ever have been taken seriously by physicians in the past, or why Francis Adams one hundred years ago praised it for its "exuberance of general truths, of grand results, and of original reflections."[5]

If one analyzes "Airs, Waters, and Places," it soon becomes apparent that it contains a schematization based upon certain assumptions. Fundamental is the belief that the change of seasons exerts a direct influence on the human body and its diseases. Therefore it is important to know when these changes will occur, and this can be done by observing the rising and setting of the stars.[6] How, specifically, will the seasons change the body? By changing the quantity of the humors through the agency of the four qualities, heat, cold, wetness, and dryness. The four seasons normally possess

[3] Ludwig Edelstein, ΠΕΡΙ ΑΕΡΩΝ *und die Sammlung der hippokratischen Schriften.* Problemata, Forschungen zur klassischen Philologie, Heft 4. Berlin, 1931.

[4] For example, C. Fredrich, *Hippokratische Untersuchungen,* 1899, Phil. Untersuch. 15 and Wilamowitz, SBBerl. 1901, 1, 16 ff., cited in Edelstein, *op. cit.,* pp. 1-2.

[5] *The genuine works of Hippocrates.* Francis Adams, Trans. London, 1849, vol. I, p. 184, footnote.

[6] *Airs, waters, and places,* chap. II (Loeb edition, p. 73).

characteristic qualities: winter being predominantly cold and wet, summer hot and dry, autumn dry and cold, and spring, the ideal season, is a moderated equilibrium of all four qualities. Under the influence of the seasonal qualities, the humors of the human body will increase or decrease. For example, in winter there is a normal increase of phlegm in the body because of the superabundance of cold and wetness in the physical environment, i.e., more phlegm is generated by the presence of these qualities, and diseases which are characterized by the appearance of this humor are therefore more likely to occur.

In the annual cycle of the bodily functions there is a certain normal quantity of humors which varies according to the season. However, if the season itself should be abnormal, this would affect the body and disease would result. For example, if a cold and dry winter (abnormal), should be followed by a wet, hot spring (also abnormal), the following season would exhibit fevers, dysenteries, and other diseases which indicate an excessive amount of humors in the body.[7] This occurred because the abnormal seasons did not regulate the humors properly, and the normally excessive winter humors were not dried because of the hot, wet spring. Therefore diseases resulted which were essentially nature's attempts to correct the imbalance caused by the abnormal environmental factors.[8]

In addition to the seasons, other external factors affect the body through their qualities. The winds, for example, are also differentiated by various combinations of hotness, coldness, wetness, and dryness depending upon their source. They furthermore are classified to correspond with the seasons, and the inhabitants of towns which face towards winds of known qualities are predisposed to certain characteristic diseases. Towns facing south and exposed to hot, wet winds contain residents of flabby physique with a superabundance of phlegm which deranges their digestive organs, makes them subject to chronic diseases like fluxes, diarrhoeas, and dysenteries, and produces epileptics, since there is likely to be too much phlegm in the brain. The inhabitants of towns facing north and exposed to cold, dry winds are just the opposite. Their sinewy, spare bodies are troubled with costiveness and acute diseases like pleurisy. Towns facing the rising

[7] *Ibid.*, chap. X (Loeb edition, p. 99).

[8] This treatise, unlike that *On the nature of man*, does not elaborate on the specific humors, or assign them to corresponding seasons: phlegm—winter; blood—spring; yellow bile—summer; black bile—fall. See *On the nature of man*, chap. VII (Loeb edition, pp. 19 ff.).

sun are like spring, in that the heat and cold are moderated, and the diseases resemble those of towns with a southern situation but are less severe. Most unhealthful are towns facing west which resemble autumn because of the great daily variations in temperature and humidity in morning and afternoon.[9]

The water supply of a town is also categorized according to its source, and east once more is signalized as the preferable direction towards which a deep-flowing spring should face, such waters being sweet, clear, light, and healthful, in contrast with the noxious, stagnant surface water which brings diseases characterized by excessive heat and dryness. Waters originating from rocks containing certain metals also possess the same hard, heating nature. Rain water is preferable to that from melted ice or snow, since the clear, light, sweet part of the water has been separated during the process of freezing, leaving the muddy, heavy part. Urinary calculi are caused by the gradual coalescence in the bladder of solid matter which originated in the residue from impure waters.[10] On the basis of these general ideas the treatise lists many diseases which are caused by the conditions indicated. The first part concludes with the admonition that grave dangers to health accompany the solstices and the equinoxes, since these abrupt seasonal changes alter the form and constitution of diseases.[11]

We know what the fate of these ideas has been, but it may be instructive to examine more precisely the development whereby the ancient assumptions were discarded. First of all, it is important to remember that until modern times "Airs, Waters, and Places" was always considered to contain necessary information for the physician and it was always regarded as an integral part of the Hippocratic Corpus.[12] Galen wrote a commentary, and it was among the earliest of the Hippocratic treatises to be translated into Latin in the fifth century. It was also translated into Syriac and Arabic, from which it was retranslated into Latin in Southern Italy in the second half of the twelfth century. Incunable Latin editions were soon followed by the first Greek edition, which was

9 *Airs, waters, and places,* chaps. III-VI (Loeb edition, pp. 73-83).

10 *Ibid.*, chap. IX (Loeb edition, p. 97).

11 Other dangerous dates were the rising of Sirius, Arcturus, and the setting of the Pleiades. See chap. XI.

12 See Edelstein, *op. cit.;* Hans Diller, *Die Ueberlieferung der hippokratischen Schrift* ΠΕΡΙ ΑΕΡΩΝ Υ△ΑΤΩΝ ΤΟΡΩΝ. Philologus, Supplementband XXIII, Heft 3. Leipzig, 1932; *Idem, Wanderarzt und Aitiologe. Ibid.*, XXVI, Heft 3. Leipzig, 1934.

published in Paris in 1512.[13] At least ten editions, most of them with commentaries, appeared in the sixteenth century.[14] The first medical topography of England was published in 1672 in close imitation of the ancient work, even borrowing its title.[15]

When ancient theoretical constructions had become subject to criticism in the sixteenth and seventeenth centuries, how far did an empirically oriented physician like Thomas Sydenham go towards accepting the ideas expressed in "Airs, Waters, and Places"? This famous critic of "hypotheses based upon the speculations of philosophy,"[16] who taught that "true practice consists in the observations of nature; these are finer than any speculations,"[17] believed that Hippocrates was the "divine old man"[18] who had created the original *methodus medendi* based on personal observation and experience.[19] Sydenham discarded ancient theory when he stressed the desirability of discovering specific remedies for diseases and asked, "What can be done by cold, or heat, or wet, or dry, or by any of the secondary qualities that depend upon them, against a disease whose essence consists in none of them?" Thus he had broken loose from ancient thought in not believing that a change in the qualities would change or destroy the disease.[20] On the other hand, his belief in the epidemic constitution stemmed directly from ancient thought. In his program for the advancement of medicine Sydenham outlined as a desideratum the natural history of diseases which should include the "particular seasons of the year which favour particular complaints."[21] While acknowledging that many diseases were present in all seasons, he asserted that others "through some mysterious instinct of Nature, follow the seasons as truly as plants and birds of passage" and he wondered why so few observations of this fact had been recorded. Furthermore, the atmospheric constitution or weather

13 Detailed references in Pearl Kibre, Hippocratic writings in the Middle Ages, *Bull. Hist. Med.*, 1945, *18*, 393-394.

14 They are listed in E. Littré *Oeuvres complètes d'Hippocrate*. Paris, 1840, vol. II, pp. 9-10.

15 Charles Clermont, *De aere, locis, et aquis terrae Angliae*. London, 1672.

16 See the passage in Thomas Sydenham, *On dropsy*, in: *Works*. London, 1850, vol. II, pp. 172-173.

17 Epistle I, in: *Ibid.*, p. 22.

18 *Medical observations*, *Ibid.*, vol. I, p. 211.

19 Preface to 3d ed. of *Medical observations*, *Ibid.*, p. 18.

20 *Ibid.*, p. 21: "In overcoming a chronic disease, he has the best and truest claim to the name of physician, who is in possession of the medicine that shall destroy the *species* of the disease, not he who merely substitutes one primary or secondary quality for another. This he can do without extinguishing the species at all; i.e., a gouty patient may be cooled or heated as the case may be, and his gout continue unconquered. This method of merely introducing different qualities can no more effect the direct destruction of specific diseases, than a sword can quench a flame."

21 *Ibid.*, p. 14.

conditions existing at a given moment could change the character of a disease by rendering the basic humoral disturbance more morbid.[22] Thus Sydenham displayed a critical mind imprisoned by basic assumptions which were part of his intellectual heritage. He explained epidemic diseases in the same way as his "divine" Hippocrates—as caused by atmospheric changes which created epidemic constitutions. However, unlike Hippocrates' theory, they "originate neither in their heat nor their cold, their wet nor their drought; but they depend upon certain hidden and inexplicable changes within the bowels of the earth" which produce an effluvia that in turn contaminates the atmosphere.[23]

Sydenham's program for the study of the correlation of atmospheric conditions, seasons, and disease, for which he set an example with a study embracing the years 1661-1675,[24] was imitated by many of his followers. Various members of the Caesar Leopoldine Academy in Germany and Bernardino Ramazzini in Italy studied local weather in its relationship with current diseases.[25] During the eighteenth century dozens of such studies were made.[26] Sydenham himself had admitted that he was never successful in correlating his data, since "the years that undoubtedly coincide in their appreciable atmospheric characters, differ in the diseases by which they are infested, and *vice versâ*."[27] But the conviction persisted in spite of the inconclusive results. Weather journals were kept by countless gentlemen scientists who faithfully measured the barometric pressure and temperature of the air, together with the quantity of rainfall, although one of them, Dr. Thomas Short, admitted that such records were "fitter for Speculation and Amusement than any useful Purposes yet known."[28] He still had faith, however, that if enough such records were kept and compared they "might afford some not contemptible Hints."[29]

22 *Ibid.*, p. 18.

23 *Ibid.*, p. 33.

24 *Medical observations concerning the history and cure of acute diseases, Works,* vol. I.

25 These were all published in vol. II of Sydenham, *Opera omnia.* Geneva, 1769.

26 See Gordon Manley, The weather and diseases: Some eighteenth-century contributions to observational meteorology, *Notes and Records of the Royal Society,* 1952, *9,* 300-307.

27 *Medical observations, Ibid.*, p. 33.

28 Preface to his "Meteorological observations," *A comparative history of the increase and decrease of mankind in England, and several countries abroad.* London, 1767, p. 121.

29 "Yet, after all these, we are left as ignorant of our own Seasons as Foreigners; for we find no Proportions assigned between our wet and dry Weather, nor of our Extremes between Heat and Cold in different Seasons, nor between different years; nor of the several Temperatures of the Air at sundry Times of the Day, and at sundry Heights or Distances from the Earth; nor of the Strength and Powers of the Atmosphere in sustaining Loads or Weight; or whether our Air is healthier now or formerly, &c." *Ibid.*, pp. 122-123.

The treatise "Airs, Waters, and Places" was frequently quoted by such investigators. John Arbuthnot, in his *Essay Concerning the Effects of Air on Human Bodies* (London, 1733), cited numerous Hippocratic observations which corresponded with his own experience, although he did not agree with Hippocrates' statements about the influence of the solstices and the equinoxes, deeming such opinions "to be fanciful, conformable to the Opinions of that Age."[30]

The four ancient qualities, in spite of Sydenham's skepticism, continued to survive in eighteenth century medical thought, although now they were part of a mechanical rather than a humoral theory of disease. Heat, cold, dryness, and moisture affected the minute fibers of which the body was believed to be constituted.[31] These fibers, or "stamina" as they were called in Latin, were considered to be the simple original parts of the body first existing in the embryo, from which the body was formed by their increase and growth. Composing the solid parts and considered most essential of all, they were found in purest form in the blood in that part which is known today as fibrin.[32] Disease was produced if these fibers should, from one cause or another, deviate from their normal state. Atmospheric changes due to weather, or material contamination caused by animal, mineral, or vegetable effluvia likewise altered the fibers. Heat, cold, wetness, or dryness with or without winds determined diseases, heat by relaxing, cold by constricting the fibers. Moisture also relaxed the fibers but, combined with heat, it might be absorbed and the total effect might be a hardening one. Excessive heat made the bile more concentrated (exalted) by dissipating its moisture, and bilious fevers resulted. Variable weather produced disease by alternately constricting and relaxing the fibers, a process which in turn affected the circulation and produced an inflammatory state in the blood.[33] Hot, moist air could also produce excessive relaxation which would decrease the force of the solid vessels propelling the body fluids and produce "Stagnation, Tumors, and Putrefaction in the Liquids" as Hippocrates had observed of warm, south winds, and which Arbuthnot had confirmed in England.[34] Many of Hippocrates' ob-

30 P. 122.

31 For a detailed historical account of this theory see Alexander Berg, Die Lehre von der Faser als Form- und Funktionselement des Organismus, *Virchow's Arch.*, 1942, 309, 333-460.

32 Thomas Fuller, *Exanthematologia*. London, 1730, pp. 53-54.

33 John Arbuthnot, *Essay concerning the effects of air on human bodies*. London, 1733, pp. 127, 151-159.

34 *Ibid.*, p. 167.

servations were also confirmed by the epidemiological studies in Germany,[35] and when discrepancies resulted, they were explained as due to local climatological conditions different from those in the Mediterranean.[36]

An English translation of "Airs, Waters, and Places" was published in 1734 by Francis Clifton, a disciple of Boerhaave, as a by-product of an abortive plan to publish a new edition of all the works of Hippocrates in Greek and Latin in a rearranged and digested form which would make them useful for practitioners.[37] Clifton's notes were confined to textual problems, and he apparently accepted the ideas without reservation. This is not true, however, of one eighteenth century physician, James Curry, whose marginal notes in the copy owned by the National Library of Medicine reveal his skepticism. Following the opening statement which observes that information about climatological data and changes of season will permit a physician to foretell diseases, Curry wrote in a clear, fine hand:

> Whether it was from the sameness in the Diet, exercise, cloathing &c of the ancients; or from the regular changes of the seasons in these times & places; that diseases were so connected with these changes, its not easily determined;—but it is very certain that modern Physicians have not found either that sameness or regular recurrence in diseases, so much talked of by Hippocrates.[38]

Commenting on the production of hemorrhages from the nose and of epilepsy in towns with a south-facing location, he said,

> We can readily see how frequent bleeding at the nose will reduce the body so much as to remove all tendency to the more violent inflammatory complaints, such as pleurisies &c: and also that Epilepsy might readily be the consequence of the same discharge but it does not appear that any particular situation disposes more to Epilepsy than another unless so far as it tends to weaken the constitution in general.[39]

Other comments like "hypothetical" referring to the presumably healthful nature of towns situated toward the rising sun, or that "the use of the spleen is still unknown; but it does not appear that it serves the purpose here mentioned" show Curry's independence of thought. His comment that "the circumstances here mentioned are evidently the result of observation but obser-

[35] *Ibid.*, p. 220.
[36] John Burton, *A treatise on the non-naturals.* York, 1738, p. 30.
[37] Hippocrates, *Upon air, water and situation; upon epidemical diseases; and upon prognosticks, in acute cases especially.* Francis Clifton, Trans. London, 1734.
[38] *Ibid.*, p. 3.
[39] *Ibid.*, p. 6.

vation misapplied,"[40] referred to Hippocrates' theory of the formation of urinary calculi.

On the other hand, Victor Amedée Magnan, who published a French translation of "Airs, Waters and Places" in Paris in 1787, accepted the text without criticism and extolled Hippocrates because "in the midst of the clouds of ancient philosophy he unveiled and seized the most useful truths for the conservation of men."[41] He thought that of all the genuine Hippocratic works "Airs, Waters, and Places" had the "most general usefulness for medicine because of the mass of facts which it encompassed and their immediate connection with their natural causes."[42]

In 1789 and 1792 Kurt Sprengel, the German medical historian, published a two-volume *Apologie des Hippokrates und seiner Grundsätze,* which contained a German translation, with commentary, of the "Aphorisms," "On Regimen in Acute Diseases," and "Airs, Waters, and Places." Confident that the basic ideas of Hippocrates were sound because they were derived from personal observations and not from philosophical speculation, Sprengel nevertheless pointed out numerous conclusions which were valid only for the geographical and climatic situation of Thrace and Thessaly. He followed Hippocrates' general views on the effect of winds on health, and he stressed the desirability of collecting observations on the winds of every country in order to obtain a general history of epidemics.[43] He cited recent authorities like Sydenham, Boerhaave, van Swieten, Morgagni, and Stoll who had confirmed some of Hippocrates' observations on winds, while Lancisi and Pringle had confirmed the role of swamps and stagnant water in the occurrence of dysenteries.[44] Sprengel did not hesitate to point out errors in Hippocrates. He himself had investigated springs and had discovered that pure, sweet springs often face in a direction contrary to that indicated in the ancient text. But he added, "In those times of the infancy of all human knowledge when men had not yet duly investigated the basic connection of things, such false conclusions were very pardonable."[45]

The most extensively annotated edition of "Airs, Waters, and Places" which has ever appeared is the two-volume work pub-

40 *Ibid.,* p. 14.
41 Hippocrates, *Des airs, des eaux, des lieux,* Magnan, Trans. Paris, 1787, p. i.
42 *Ibid.,* pp. iii-iv.
43 Kurt Sprengel, *Apologie des Hippokrates und seiner Grundsätze.* Leipzig, 1792, vol. II, p. 517, also p. 542.
44 *Ibid.,* pp. 532-538, 550-551.
45 *Ibid.,* p. 555.

lished in 1800 by Coray, a Greek physician trained in France, who presented a revised Greek text, a French translation, and extensive historical and medical commentaries.[46] "L'ouvrage étonnant," as Coray labelled it, had in his opinion solved the most interesting problem which had ever been proposed: why men in different parts of the world differ, in spite of their identity of species.[47] He was thus chiefly interested in the second part of the treatise which we have not discussed, and he was publishing "Airs, Waters, and Places" in order to reconfirm the climatic thesis of national character, recently restated by Montesquieu, but which others like David Hume and Helvétius had rejected in favor of moral causation.[48] He accepted the greater part of the ancient doctrine, discounting the possible astrological interpretation which could be put on the sections relating to astronomy.[49]

Forty years later, in 1840, Émile Littré re-edited and translated "Airs, Waters, and Places" as part of his monumental ten-volume edition of the complete works of Hippocrates.[50] Reflecting the advances of scientific method in medicine which had been achieved in his day, particularly in the realm of biostatistics, he criticized Hippocrates for presenting his conclusions without adequate proof and for not demonstrating the means whereby they had been obtained so that they could be verified. Today, he remarked, one would demand detailed statistical evidence over a period of several years in order to establish the general truth of particular facts. However, he believed that the basic doctrine of "Airs, Waters, and Places" was "one of the most beautiful heritages which modern science has received from ancient science,"[51] and that studies on the influence of situations, winds, waters, and climates should be made on a vast scale all over the world. Hippocratic observations of the abrupt changes occasioned by the solstices and the equinoxes, he asserted, had been inspired by a climate where the seasonal changes were more clear-cut than in France.[52] Comparing "Airs, Waters, and Places' with the Hippocratic work "On Ancient Medicine," Littré concluded by indi-

46 *Traité d'Hippocrate des airs, des eaux et des lieux.* Paris, 1800. German trans., Vienna, 1804; Spanish trans., Madrid, 1808.

47 *Ibid.*, I, pp. i-ii.

48 A brief historical sketch of the effect of climate on national character is in Z. S. Fink, Milton and the theory of climatic influence, *Modern Language Quart.*, 1941, March, 67-80. Coray (note 46), I, pp. xxx-xxxi.

49 *Ibid.*, p.lxi.

50 E. Littré, *Oeuvres complètes dHippocrate.* Paris, 1840, vol. II, pp. 1-93.

51 *Ibid.*, p. 2.

52 *Ibid.*, pp. 6-7.

cating that both had the same basic method of studying man in relation to everything which surrounded him. "It is a method which should lead," he asserted, "to positive and profound ideas about the human being. In fact, what is more positive and at the same time more profound than these insights on the action of general causes, and on the incontestable relationships which bind man with cosmic influences?"[53]

Meanwhile a new approach to medicine had changed the focus of interest. Led by physiologists like Magendie, Claude Bernard, and Johannes Müller, physicians sought to understand the nature of disease by a minute investigation of the functioning of the body in both health and disease. Instead of considering man in nature, they viewed him as an isolated physiological system, subject to physical and chemical laws which operated without apparent dependence upon environmental factors. In 1855 Charles Daremberg, editor of the next French edition of "Airs, Waters, and Places,"[54] deplored this separation of man from nature and, like Littré, urged that climatological studies be continued with the aid of the new instruments of science. He pointed to current studies on medical geography which seemed to establish the thesis of Boudin that "just as every country possesses its characteristic vegetable and animal kingdom, in the same way it possesses a disease kingdom, its own diseases exclusive of certain others."[55]

The final breakdown of the Hippocratic thesis was, of course, caused by the discovery and identification of microorganisms as the specific agents of epidemic diseases, the area in which the ancient theory seemed to be most plausible. The last reprinting of "Airs, Waters, and Places" for purely medical, and not medico-historical or philological, purposes took place in 1874, at a time when some physicians still wrote of the beneficial effects of winds which dried up "the sources of fevers and other ills resulting from decaying vegetables."[56]

While the attempt to correlate disease with climatic and weather conditions is still made by some investigators,[57] this ap-

[53] *Ibid.*, p. 8.

[54] *Oeuvres choisies d'Hippocrate.* Charles Daremberg, Trans. 2d ed., Paris, 1855, pp. 296-389.

[55] *Ibid.*, pp. 302, 303.

[56] Hippocrates on airs, waters, and situations, trans. from the Greek by Francis Campbell, *New South Wales med. Gaz.*, 1874-1875, 5, 49-54, 80-85, 104-108, 147-152. Quotation on p. 83.

[57] For example, studies like those of W. F. Petersen, J. S. Howe, and M. E. Milliken, *The patient and the weather.* 4 vols., Ann Arbor, Mich., 1935; William F. Petersen, *Hippocratic wisdom.* Springfield, Ill., 1946.

proach is no longer in the mainstream of medical thought. Modern research workers might admit that meteorological and climatological phenomena are probably indirect causes in a complicated causal nexus; for example, as determining the conditions favorable for the generation and multiplication of pathogenic organisms which are the immediate cause of disease, or they might relate specific meteorological episodes and the onset of illness in terms of the stress to which they subject the organism, but the philosophical ideas embodied in "Airs, Waters, and Places" are meaningless for contemporary research.

This study has shown that each age before the present one read into "Airs, Waters, and Places" what it wanted to find there, using it as an authority for current medical hypotheses by accommodating it to recent views. It was always possible to discount particular sections too divergent from contemporary thought while extolling others. Like a religious document, it was made to fit every time and place. Only after medicine had advanced to the level of a true science with proven cause and effect was this sacred document of its heritage discarded.

Jacobus Sylvius' Advice for Poor Medical Students

TRANSLATED BY C. D. O'MALLEY*

A FEW years ago the late E. P. Goldschmidt, distinguished London bookseller, issued his unusual *Catalogue One Hundred* which listed not books for sale but rather one hundred notable books and manuscripts which he had sold over the course of more than a quarter century. The *Victus ratio scholasticis pauperibus,* presented below in an English version, has its place in that select company, with notation that it had found a home at "Yale Hist. Medical Library, New Haven," that it had hitherto been undescribed, and that "a full translation and publication of this handbook would surely be of great interest."[1]

The treatise bears no indication of author although it was in fact written by Jacques Dubois (in Latinized form Jacobus Sylvius), the celebrated sixteenth century Parisian physician and teacher, perhaps best known today as teacher and later bitter enemy of Andreas Vesalius. That unfortunate relationship and Sylvius' ill-advised and unrestrained attack upon his former student have in particular led to some possibly erroneous judgments about his character. Cross-grained Sylvius certainly was, as Noël du Fail, another of his students, clearly indicates,[2] and in his *Vaesanus* Sylvius demonstrated that he could be vindictively and even hysterically savage in defense of Galen. Nevertheless, beneath this shaggy exterior he seems to have possessed a genuine concern for the well-being of his students; a little of this comes through the preface to Vesalius' *Fabrica* and is even suggested in the *Letter on the China Root,* Vesalius' defense against Sylvius' first criticisms of him.

Sylvius was himself a man of modest origins, and despite his later concern with the accumulation of wealth, he appears to

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1 *Victus ratio, scholasticis pauperibus partu facilis & salubris.* Parisiis, apud Iacobum Gasellum, è regione divi Christophori, prope collegium Camerasensce, 1540. 30 unnumb. *ll.* While the Yale copy of the original edition appears to be unique, the work was reprinted in *Thesaurus sanitatis paratu facilis electus ex variis authoribus, per Ioannem Liebaultium,* Parisiis, 1577, ff. 6^{v}-18^{r}.

2 *Oeuvres facétieuses de Noël du Fail.* Assézat, Ed. Paris, 1874, II, pp. 145-146.

have retained an interest in the plight of the impoverished, in and out of academic circles. This is apparent not only in the present work but also in others which he wrote on related subjects, as their titles suggest: *De parco ac duro victu, Consilium perutile adversus famen & victuum penuriam* and *Exhortatio ad divites.* Sylvius the philanthropist is a subject which has thus far not been given much consideration,[3] and the usual picture of him is that of a wealthy but avaricious man very unlikely to give heed to the problems of the poor. It is entirely possible that his social ineptness has been incorrectly interpreted to the disadvantage of his memory and that beneath a somewhat thorny exterior Sylvius had never forgotten the trials of his own youth, but remained sympathetic to the similar problems of later generations of students. In one instance Moreau's biography,[4] which has made its contribution to the usual description of Sylvius, does give some indication of a kindlier spirit under the rough outer shell. After declaring Sylvius to have been "boorish," Moreau continues by stating that he was "very harsh and coarse, grave, strict, but not without a certain urbanity and affability; of hoarse but loud voice . . . with dense and rough beard and a very full head of hair, although he was so averse to its length in others that when he saw a beggar with long hair he would send him to the barber, and as well to the baker, and pay the bill." Upon his death in 1555 Sylvius was buried in the Cemetery of the Poor Scholars in Paris, which may or may not be some reflection of his genuine feeling.

Turning to a brief inspection of his proposed regimen for poor scholars, it must immediately be stated that the daily life of these students probably did not conform exactly with Sylvius' well-meant suggestions. The sober advice of a man of sixty-four would not likely, even in the sixteenth century, be entirely acceptable to a youth in his early twenties. Nevertheless, in broad outline the picture of how the university student of slender means maintained existence is probably correct. The upper levels of society have always had their chroniclers, but information on the existence of others, especially in earlier centuries, is not easily come by. Sylvius' little book of advice has among its merits that of making a contribution to this slim body of information.

[3] Louis Thusane appears to have been the only one to touch upon this. *Revue des Bibliothèques,* 1905, *15,* 274 ff.

[4] "Vita [Sylvii] opera et studio Renati Moraei," in *Iacobi Sylvii opera medica,* Genevae, 1634.

VICTVS RA-
tio, ſcholaſticis paupe-
ribus paratu facilis
& ſalubris.

PARISIIS.

*Apud Iacobum Gaſellum, è
regione diui Chriſtophori,
prope collegium Camera-
ſenſce.

1542.

QVum multo cui-
que ſit optatius
morbum vitare,
quam ipſum iam
genitum curare: in morbos
vero & frequentiſſimos, &
plurimos, & ſæpe grauiſſi-
mos incidãt ſcholaſtici pau
peres: tum ex praua victus
ratione, tum ex intempeſti-
uo & tardiore vſu remedio
rum, mihi in mentem deus
optimus maximus immiſit,
diætam illis & promptam,

Title-page and verso of Jacobus Sylvius' *Regimen for Poor Scholars.*

A sixteenth century engraving of Jacobus Sylvius, (redrawn from the better known portrait) in which he appears much younger.

A REGIMEN FOR POOR SCHOLARS, READILY OBSERVED AND WHOLESOME

Everyone prefers to avoid illness rather than to treat it after it has arisen, but partly as the result of incorrect regimen, partly due to untimely and very tardy employment of remedies, poor scholars are frequently afflicted with a great variety of, and often very severe, illnesses. Consequently God put it in my mind to prescribe a regimen for them, both readily observed and wholesome, through which they might more successfully resist the causes of illnesses; yet if through carelessness they should at times be slightly afflicted, let them consult physicians about certain remedies which are readily and easily prepared lest the ailment become deeply implanted and then they implore the physicians' help in vain.

In order that this regimen of mine may be more easily comprehended and observed by every one, I shall discuss it according to the order of the normal daily activities of one of the scholars.

Early in the morning when the muses call, whether because it be necessary to attend upon your preceptors or the mute masters (as they are called), let each one determine whether or not he has had sufficient sleep and let him give full consideration to the quantity and quality of yesterday's supper, for a very abundant meal of crude food is very difficult to digest and requires a longer period in the stomach.

If you can detect with your hand that the stomach's swelling has subsided, and if you are not afflicted with belches arisen from the quality of yesterday's dinner, and if you feel that your whole body is prepared for movement and your spirits ready for action, rise and put on your usual clothing. However, if it seems to you that your supper has not yet been fully digested, but if you do not wish to sleep longer, nevertheless remain for a little time in bed with the palms of your hands or the fleshy part of your forearms resting over your stomach.

In cold weather, if the upper part of your body has been properly protected against the harmfulness of that cold, and with the rest of your body covered with down and coverlet, assume a sitting position and read for a time; let the lamp be enclosed in horn unless you require a bright light. But if you rise completely, rub and chafe your whole body vigorously for a time with your hands. Then lest the cold suddenly afflict your exposed body, quickly put on your clothing which has been warming in the bed. If your feet are cold, stand up on that part of the mattress which still retains the greatest heat, and in this position truss all your points as you normally do unless you are accustomed to have a bowel movement at this time.

When you have left your bed and put on your shoes, or slippers or even boots, move about, blow your nose, cough, spit, and while walking about massage your head very carefully with your fingers, and comb it with a clean, well-wiped comb, one which is undamaged so that it may not

pull out or break off hairs. While you are walking about, frequently stretch your limbs and hold your breath so that you may arouse the bowel, and once it has been aroused it ought not be neglected lest then ignored later it be recalled in vain, and that sharp, biting matter which has been provoked run back and upward to produce headache, as happens daily to many.

While you are rising and walking about, supplicate God earnestly that you may lose no time through idleness, and through the exercise of declaiming the lungs and thorax will assist somewhat in the expulsion of any excess matter from the lungs.

If it is necessary to read, sit quietly in some suitable place, the whole spine and body erect, the text held up as if on a surface parallel to the horizon with your eager eyes on a similar plane. First read quietly and in a diffused light, unless you suffer dimness of vision or some other defect of vision or have been accustomed to a bright light. Moreover, read with your eyes and mind and not like those who use the voice and weary themselves and everyone else. If possible let the type be prominent so that it is less harmful to the vision. To preserve their vision some read by lamps enclosed in horn, while others interpose a green or a blue glass shield between their eyes and the light. Do not place the light before your eyes, but let the flame be rather at the left of the text, although it is also permissible at the right so long as the rays do not travel directly to your eyes from either position; but let the light be a little to the rear on whichever side.

The lamp wick because of its slenderness ought rarely be wiped lest it cease to carry fuel and give you trouble. Oil is cheaper than tallow candles, even those long ones with a very thin wick commonly used by the Franciscans. Naphtha is usually cheaper than flaxseed oil, hempseed oil has a very strong odor like that of tallow candles, while grapeseed oil is cheap but crude. Therefore it will be worth while to make a paper chimney as an outlet for the fumes of each of them. If you fear the expense of a wick, substitute asbestos for it (which shops wrongfully and wickedly substitute for scissile alum), the stalk of lychnitis or the pith of the rush.

Read attentively such accounts as are to your purpose; divide them up into their parts and observe the meaning of each; in short, follow the precepts of Quintilian, Budé, Erasmus, Vives, and other learned men regarding a plan of study, which I intentionally omit because it cannot be properly considered in few words.

When you have become weary of reading or have satisfied your purpose, collect what you have read under a few headings. Consign these things to your memory, if you can trust it; afterward if you have studied something else, recall those things which you learned previously, either by yourself or with some fellow-student.

If you must listen to some learned teacher, observe his method and organization attentively, what he says first, second, and third, and why in this order. If you wish, make some notes, putting all these things under special headings, and when you return to your room, repeat the individual things to yourself or to another. If you put little trust in your memory, make detailed notes of them so that they may be of use to you later. Some write down their teacher's words verbatim, but since their attention is almost wholly given to writing they have little comprehension of the meaning of these things except as they afterward study them, when they may enjoy them fully and for a long time. However, I do not wish you to keep your eyes elsewhere than on your teacher's face, and much less do I desire you to allow your mind to wander lest present in body you be absent in spirit; furthermore it is not desirable that you converse with another about literary affairs while you are supposedly giving attention to your teacher.

I especially desire that you always have learned masters who are vocal rather than mumblers; so Aristotle considers the significance of teaching to lie in its audible quality and maintains that the delivery of the live voice has a certain latent significance. Not only do those things heard penetrate further into the mind than those seen, but in one hour you may comprehend the matured fruit of your teacher's many days or even months or years of study. Furthermore, such a teacher is heard with the least disturbance to the eyes and to the well-being of the body. On the other hand, books are read with great sacrifice of the eyes and the seated body, especially those in Greek and even more so those in Hebrew, since it is necessary to concentrate the visual spirit fully to distinguish their many accents, points and minute characters.

If, while you are reading or listening, your feet, hands, or other parts of the body become cold or, as is frequently the case, your whole body, if your sleeves and the rest of your clothing are ample, cover yourself with them, and they will warm you quickly and thoroughly and so ward off the cold's harmfulness, or rather prevent its penetration. If your feet and the soles of your shoes or boots, especially within, are clean, they will be less susceptible to cold; otherwise, however much you have warmed them, that earthy excrement which usually clings to the feet and their covering will soon become cold again. Therefore as often as each month wash your feet with warm water, or, if that is not available, wipe them carefully with a dry and rough cloth in the evening and, if you desire, massage them with your hands. In the spring if possible wear socks of loosely woven wool, wool in the winter, and in the summer a webbing often changed and washed; keep your feet off the ground as much as possible by wearing slippers or sandals.

If you are unable to overcome the cold even by these means, stretch and flex your fingers and move your feet about; if permissible, strike them together and walk about. If even thus you cannot overcome this difficulty,

sprinkle a fine powder of well-dried leaves or berries of laurel or the leaves of salvia, rosemary, or similar plants into the bottoms of your boots. If your shoes are in good condition, do it three or four times, but don't allow your shoes to be open to the skin; if they are torn, draw the edges together and sew or stop up the tears, most desirably with leather but otherwise with linen or woolen cloth. If the rest of your clothing is worn and has many tears and small holes in it, sew them together with cloth; if that is not available, with leather or even parchment or paper; you can in this way cover your whole leg as if with a boot. When this has been done the cold cannot penetrate nor the inner heat escape. In this same fashion place thick paper such as writing paper or old parchment, which is cheap, over your stomach or whatever other part may be cold; it need not be frequently changed. It is for this purpose that women in particular cover the head with a little cap in the region of the coronal suture where the cold is felt most, since it is there that the pituita collects as into a funnel for the whole body.

When you have become weary of reading or listening, and if you are still cold, resort to friction or some other exercise of the whole body, first mild, then stronger, and finally vigorous or even exhaustive; in this way you will not only expel the remains of the cold but also increase the native heat, strengthen the solid parts, and drive out any excrements which have sluggishly remained in them, although if possible first through the bowel and by means of the urine. Such heat from exercise of the parts is clearly apparent to us even in its smallest degree and it lasts for a long time; on the other hand, the heat of a flame although of great force is tenuous and vanishes, and like the heat of summer it dissipates our own heat. Hence even were you to have sufficient fuel so that a fire might be kept on your hearth throughout the entire day, it would not be desirable unless you were so chilled that a fire were immediately necessary to overcome such severe cold, which, as I said, is not a wholesome practice.[5]

Try to warm yourself by moving all parts of your body, and as by degrees you move them more swiftly, robustly, and vigorously, so by degrees you will be invigorated by these different motions. If this causes you to sweat, wipe away the sweat and continue more slowly for a longer time so that the sweat produced from the heat of your body may be changed into a glistening vapor and not leave you with a moist covering conducive to cooling.

When you have rested and your body has been restored to an equilibrium, if you have something to eat, make your breakfast, or rather

[5] According to Moreau, *op. cit.*, "in the middle of a severe winter he was sparing of fuel; he was accustomed to play a kind of game with a tennis ball in a small inner court as well as to carry thick blocks of firewood on his shoulders from the lowest part of his house to the top floor to generate heat throughout his body. He said heat was aroused more healthfully by that motion and action than by fire and stove." Moreau has furthermore stated, and others have agreed, that Sylvius' actions represented "avarice" and "disgraceful cupidity for wealth." Yet it is possible that an injustice has been done to Sylvius.

have your first meal, so that now that your bodily heat has been aroused you may not be weakened by lack of sufficient nourishment or burn up blood or draw excrements from the rest of your body into the stomach and the individual parts and use them for lack of something better.

Prepare for yourself foods that are wholesome, easily prepared, and cheap such as the following. Take some sort of white or brown bread which has been well cooked and slightly fermented, not salty and of medium hardness. Cook this in water and so prepare a gruel for yourself; it will be more pleasing to the taste if you are able to flavor it with a little bacon fat, rendered pork fat or the like, or even butter.

I do not advise you to cook wheat in place of bread in water, although it is permissible to cook it, as well as cleansed barley, rice or oats, in water and vinegar with oil or butter, anise and leek, millet or panic grass. In cooking the bread or barley, cow's milk may be used wholesomely in place of water or with water; also beer if you are used to it, or a broth of good quality meats collected from your meat kettle. However, add water at the start so that that juice does not become too salty from long cooking, unless it has not yet been salted; such is the practice of the cooks in the scholars' colleges who boil the dinner meats lest their fat be spoiled by salt and the candles made from that fat constantly crackle.

You can produce a broth with onion, garlic or leek, unless you fear heaviness of the head or heat of the whole body, or dislike them. During the cooking of the cereals, if more water must be added, let it be hot lest those things be poorly cooked, as Galen teaches in his book on nourishment. If it is very cold, you can produce both a sauce and a condiment with powder of fresh salvia, hyssop, thyme, rosemary, and the leaves and berries of laurel.

If perchance you can feed on meats when other things are dear, pork, both suckling pig and young pork not very strongly or long salted, may be used. If it be necessary to eat beef, let it be fresh and young, for salted and aged it is more difficult to cook and gives rise to melancholic blood.

In place of bread you may put barley, rice, or similar cereals in a hempen bag and pound them into a farina. Sift them through a closely woven sieve, add a little salt and, if you desire, a little of the powder shortly to be mentioned, cook in water and dry in the wind or sun lest it spoil or become corrupted. Several spoonfuls of this farina can then be cooked in water until it is somewhat thickened into a gruel to which you may add some of the aforementioned fat.

Some prepare a gruel with cheese, especially that which is fat and glutinous, cooked in water; but since all cheese, and whatever is thick and viscous, may give rise to the stone, unless cheese does not ordinarily bother you avoid that gruel however much and long-sustaining its nourishment, and investigate frequently whether or not the veins and their branches

in your liver, spleen, and kidneys are blocked by this or similar nourishment. So much for this very nourishing and easily prepared gruel.

If you desire a very simple sauce, onion cooked in water with a little salt ameliorates an upset digestion, or if you fear the heat of onion, use spinach, beet, lettuce, and purslain. You may cook your gruel in water with a little verjuice of grape or wine, salt and butter, and if the weather is cold, add savory, hyssop, thyme, marjoram, rosemary, and salvia, &c., to your sauce.

It is a very good idea to cook edible roots in the broth; in cold weather, for example, parsnips with daucion, erice, carroway, wake-robin, wild parsley, and radishes; but in warm weather all kinds of turnips with a little of the aforesaid roots or herbs added so that the turnips may not produce flatulence. They may be added in the same way to peas, beans and chestnuts and by cooking these three, as well as sweet lupine, chick-peas and vetch, in a thick broth you can weaken their strength so that they may be used more frequently for nourishment. The beans and chestnuts especially produce the blood praised by Galen, and in their cleansing force and nutritive value they do not yield to barley. If at night they are pricked with needles and then soaked in water, the following day they will dissolve more readily into the broth without so much cooking and will be very nourishing for a long time.

You can also make a healthy and pleasant nourishment by cooking cucumbers, squashes, and the like, as well as apples and pears, with water, bread, a little salt and butter; in the winter add a suitable quantity of your powder. However, the frequent use of this food, especially in the winter, generates a crude juice.

A broth may be prepared by cooking carp in our salted fish sauce, but if you fear the salty after-effect of our fish sauce, then when the fish has been cooked, let it be cut open at the back and stuffed with fresh, unsalted butter and a dash of vinegar or verjuice of grape. I advise you to do the same for sturgeon (commonly called *morua*) and other salty fish. Of all our fish that usually called merling has an especially light, soft, and friable flesh, but it is not popular because of its insipid taste. Nevertheless, if gutted and stuffed with a little salt, smoked for several hours, and then roasted lightly in a little fat, it will make a food very pleasing to the palate and stomach, easy to cook, and not yielding to rock fish in the goodness of its broth.

Fresh eggs cooked in water so that they are soft and sorbile are best eaten with bread. They are not to be scorned if lightly cooked in butter with crumbled bread. Roasted or boiled chestnuts, almonds, hazelnuts, prunes, raisins, and dried figs are to be recommended, especially for fast days. I advise you to avoid the baker's wares because they are very expensive and unhealthful, and even more so all kinds of fungi because they frequently

generate a crude juice, especially in the stomachs of those who are not in the best of health.

Let your drink be weak wine unless the weakness of the stomach requires a better; in place of wine, especially if it be expensive, there is ale or beer if you are accustomed to them, or at least not averse nor previously found them offensive as a drink. Also you may drink milk mixed with water or water cooked with bread or raisins, prunes, grapes, licorice, barley, or similar things. After dried prunes have been pricked with a needle and soaked in water they will make a pleasant drink for you on the following day, especially if they are sweet, but if not let raisins be added. Whey and buttermilk may be drunk in warm weather, or ptisan (of which a spoonful retained in the mouth for a time greatly alleviates thirst for a long period, even if you are walking or are feverish), or opomel, oxicraton or *posca*, which last is water diluted with a little vinegar so that you are able to drink it without harm. Also meat broths, especially those of good quality meats, do not yield in goodness to the most excellent drinks or to whatever other of those aforementioned cold liquids you desire.

In the winter when there is great lack of wine, drink the hydromel of Mesue, or the honey wine celebrated by Pliny, which is very easily prepared and inexpensive. If it is prepared correctly as we teach in our Mesue,[6] it equals even superior wines in its flavor and heat. When apple, pear, medlar, cherry, cornelian cherry, mulberry, persimmon wine, and the like have been decocted I have them strained into jars so that they will not be harmful to one accustomed to them or to one sampling them.

At your second meal, if you are able to live so elegantly, you may eat grapes or raisins, fresh or decocted from a ptisan, and apples; also pears cooked or roasted in butter, or buttered after cooking and flavored with fennel or sprinkled with your own condiment, are to be recommended; likewise prune or cherry pits, crusts of bread, fennel or anise. If you are free of suspicion of the stone, you may eat fresh cheese in the summer and in the winter, aged.

Let your mealtime conversation be of literary matters, but of subjects which do not require great intellectual effort such as things read or heard from a teacher, but not such as may hinder the eating of your food. Let your food be well cooked, tender, cut up, chewed, and as much as your stomach can digest comfortably. Be very sparing of drink unless more is required by a constricted bowel or for other reasons.

Let your fire be in the middle of your study or in some space in your bedroom, but elevated so that you may enjoy it from all sides; do not place it under a chimney against a wall, as is the stupid fashion today, for not even the quarter part of such a fire is of use to us since the chimney

[6] A reference to Sylvius' frequently reprinted edition of the *De re medica* of Mesue.

(as it is called) nullifies and intercepts some of that fourth part of the heat left to us. Enclose your small fire within well-baked clay bricks or iron, elevated as I said, and lest it give off an odor construct an exit by which the smoke can be carried outside your chamber. Coal, bark, and the dreggy mass from leather-tanning (commonly called *turbae*) provide a simple and lasting fuel for your fire, but each has an offensive odor, suffocates by its thick and unpleasant exhalation, and harms food cooked over it. Therefore neither these nor dung ought to be used except for the sake of heat, and then all the vapor must be carefully drawn a long distance off. Furthermore, charcoal and green woods are not suitable for cooking food because they are filled with a heavy vapor and render the food unpleasant to the taste. Therefore, let them be half burned before you cook any food over them since then they seem to be less damaging; indeed, use half-burned fuel in place of other things on your hearth or, even better, always use dry wood which gives off no bad odor.

You may warm your bedroom, which ought to be small, by a small but raised stove placed in the middle, and if it has an outdoor vent, you may use charcoal or fresh wood in it; and let that pot which you and those who share expenses with you employ for many common needs be placed over the mouth of the stove. If your bedroom is warmed by a stove, wear little clothing while in it, but if you must go outdoors, wear suitable clothing to protect yourself from the cold which readily penetrates into a body rarified by heat. Do not, like some, permit your chest, part of your belly, and your knees to be exposed to the air, and especially protect any chilled part.

After dinner when you have expressed proper gratitude to God, wash your hands and mouth with plain water, or with a little wine in it, carefully clean your teeth with a twig of rosemary or a reed, but not with a pin or straw lest you injure the roots or nerves of the teeth or the vessels of the gums. It is very important that you rub the teeth with that herb called hippuris, that is, dried horse-tail, because it was recommended by the ancients as cleansing the teeth better than mastic, and its astringency also strengthens all the aforesaid parts better than mastic. After you have done these things walk about slowly and meditate upon something trivial but not base with your learned fellow-students, all the while holding yourself no less erect than at your meals or studies. If possible, listen rather than read for two hours after food, and do not write for two or three hours after a full meal; turn to literature (but according to my earlier precept) sit erect and in a favorable light. Afterward exercise your body so that in accordance with the Hippocratic precept labor will precede food.

Take your supper like your earlier meal, with great sobriety. Conduct yourself after it as after your earlier meal, and if anything is to be read, let it not be contentious or lengthy, but preferably recall the course of your day and review your studies.

If it is cold when you are preparing to surrender your body to bed for rest and the restoration of the animal spirit, warm yourself by walking about; if this does not suffice, build up a little fire from scraps, but if even then your feet are not sufficiently warmed, even when thrust against the hottest part of your boots (that called the sole), go to bed.

If you dread the nocturnal cold, join and draw together the lower corners of a sack with a cord (this is usually called a head-piece [night cap]); if you wish, place some heavy blankets about you, or some hempen cloth stuffed with dry fodder, straw or hay will be of great service in place of blankets. As during the day, so at night it is a great protection against the injury of cold to wear several garments, perhaps made of hide or leather, not a loose, ankle-length gown but tight, constricting clothing that presses against the body. To warm your feet more swiftly draw them up against your rump; then breathe into the bed, place your hands or the fleshy part of your forearms on your stomach, lie first on the left side or the right side unless habit or something else prevents this, and after you have commended yourself to God you will quietly go to sleep. If during the night you are aroused by a cough or the need to spit, as also happens during and after meals, do so that the lung and heart may be emptied of excrement.

At dawn, or before it is necessary for you either to read or to rise, rub your whole body briskly with your warming hands. It is a good thing for you to arouse a sweat, or at least a moisture, twice a week, even in winter, unless your daily exercise suffices for this purpose. You will not only hasten but also increase this heat if you walk about weighed down by your clothing or something else or move about very rapidly, because by this rapid and at the same time robust and vigorous exercise the bones and cartilages produce great friction, the author of heat, in all the joints. The heat is distributed from the joints into the ligaments, tendons, and muscles, and through their arteries and veins into the heart and liver and thence into the whole body. Cold ought to be avoided as more dangerous than a dog or serpent, internally through drinking water and eating raw fruits, and externally through clothing the body too lightly and exposing it to chilling and icy weather.

If you desire to lead a long, unharmed life as a priest of the Muses, observe all these wholesome precepts; but if you have been indiscreet and an ailment threatens you, then consult a physician, but let him be a skilled one.

Nicholas Culpeper and His Books

F. N. L. POYNTER*

NICHOLAS Culpeper is one of several medical writers of the seventeenth century whose writings challenge investigation because of their bibliographical obscurity. I have for many years been collecting materials for a definitive bibliography of Culpeper, a project which I discussed with John Fulton when I visited the Historical Library in May 1956. In England, where Culpeper's invective against the College of Physicians is now quite forgiven, even if not forgotten, I had become accustomed to taking up a somewhat defensive posture about my interest in "that old quack," and it was pleasant to learn that the fine collection of his editions in the library at Yale reflected the great Harvey Cushing's interest in that somewhat disreputable figure. A collection of similar range in the Wellcome Library bore (and bears) witness to my own endeavors and it seemed a happy suggestion of John's that we should make the bibliography a joint project of which the Cushing-Wellcome collections would form the nucleus. It had not progressed beyond a preliminary (unpublished) check-list when I was invited to contribute to this John Fulton memorial number of the *Journal,* and it seemed fitting that a study in which he had hoped to participate should be associated with his name in this way. My first intention was to give it the title "Nicholas Culpeper—a revaluation," but the revaluation must await the completion of what has proved to be a time-consuming if fascinating task. Before we can accurately judge the value of any man's work we need to know precisely what it comprises, what were its sources, and what influence it exerted upon his contemporaries and succeeding generations. What I have to say about Culpeper at this stage of my researches should therefore be taken as preliminary observations rather than as considered judgments.

Is Culpeper worthy of study at all? May we not accept the general verdict on him as a vituperative quack who well reflects the turbulence of his times and as the founder of a modern herbalist cult which flourishes at the expense of orthodox medicine? I should be content to let this verdict stand if it could be justified by the

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facts, but—to me at least—it seems to be so false that it might almost be characterized as "anti-historical." If our concern is the history of medicine as it was professed and practised, then Culpeper is a figure of outstanding importance, for he had a far greater influence on medical practice in England between 1650 and 1750 than either Harvey or Sydenham. His writings reflect faithfully the orthodox medicine of his own time, and his translations of the leading European medical writers of his age gave to English doctors for the first time a comprehensive body of medical literature in their own tongue which represented the best contemporary authorities. The definition of a "quack" in the *Oxford English Dictionary* is "an ignorant pretender to medical skill; one who boasts to have a knowledge of wonderful remedies; an empiric or imposter in medicine." When we consider the education, training, and licensing of medical practitioners in seventeenth century England and set the facts of Culpeper's life and work in that context, it will be seen that he did nothing to deserve censure. It is true that he abused the College of Physicians beyond the limits of decorum but in a country politically divided they were on different sides, where each gave as good as it got.

The account of Culpeper's life given in the *Dictionary of National Biography* contains a number of errors, which is the less excusable because a brief biography was published only a few years after his death[1] and when his widow and daughter and many of his friends were still living, so that, whatever we may think of the opinions, we should require contrary evidence to doubt the facts as they are there given. Nicholas Culpeper was born in London on 18 October 1616, less than two weeks after the death, at the early age of 34, of his father, the Rev. Nicholas Culpeper, Rector of Ockley. He was brought up by his mother who "took such care for his education, that she spent four hundred pounds on her said Son, for his Diet, Schooling, and his being at the University of Cambridge, where he continued some years, profited in all manner of learning, and gained the applause of the University whilst he remained there." He was intended for the Church and was one of the heirs of his maternal grandfather, the Rev. William Attersol, Vicar of Isfield near Lewes in Sussex. Whilst at Cambridge, he fell in love with a girl who belonged to one of the leading Sussex families, and, having obtained £200 from his mother, he planned a runaway marriage and suddenly left the

[1] *Culpeper's School of Physick*, London, 1659.

university. On her way to the rendezvous near Lewes, where they were to be married, the girl was struck by lightning and killed. It is said that Culpeper had studied astrology and occultism from the age of ten, and this ominous event made such an impression upon him that he refused to complete his studies at Cambridge; eventually his grandfather placed him as an apprentice, with a fee of £50, to a London apothecary near Temple Bar. This was Daniel White, who had been granted the freedom of the Society of Apothecaries in September 1630, and who, after Culpeper had been with him a year and a half, went bankrupt and fled to Ireland. A new master was found in one Drake, an apothecary in Threadneedle Street, "where being himself excellent in the Latine, he taught Mr. Drake that Tongue in less than a year and a half." When Drake died, soon after this, Culpeper "still remained with Mr. Samuel Leadbeaters, who formerly lived with him; and afterwards took his Master's shop within Bishopsgate, where for some space of time he studied Physick. In which application of his, he shewed a great deal of wisdom to chuse a Profession according to his own disposition and inclination, the strongest Indenture to bind a man to the happiness of a noble and successful enterprise."

It seems that his grandfather considered he had done enough for his grandson by meeting the expenses of his apprenticeship, for when he died on 30 May 1640 he left £400 a year to be divided between his other grandchildren and to Nicholas he left a legacy of forty shillings, "which was paid him by the two Executors at Nathaniel Brook his shop at the Angel in Cornhill. This small sum he received with a smile, and said, He had courted two Mistresses [i.e., astrology and physic] that had cost him very dear, but it was not the wealth of Kingdoms should buy them from him."

It was in this same year that he married Alice, the 15-year-old daughter of John and Alice Field. Of this marriage there were seven children, only one of whom, Mary, the fourth, survived the hazards so common to childhood at that time.

At some time during the first three years of his marriage, Culpeper fought a duel and wounded his opponent so seriously that he fled to France and remained there for three months until his injured rival was cured at his expense. It may have been a result of this affair that he spent a term in prison, but in 1643 he joined the rebel army and was wounded in the chest by a musket shot "which he never recovered of till his dying day." After this he attempted to lead a quiet life, no doubt spending much of his

time upon the translations of leading medical works which he left behind him at his death, but was "then so unexpectedly taken notice of, as to be put upon the Translation of the Doctors *Dispensatory.*" This English version of the *Pharmacopoeia Londonensis* was the first of many publications which were to occupy him for the remainder of his short life. He suffered from tuberculosis, which consumed him "until it reduced him to a very Sceleton, or Anatomy," and he died in his house in Spitalfields on Monday, 10 January 1654, in the thirty-eighth year of his age. He was buried, according to his own wishes, in the "New Churchyard of *Bethlehem.*" It was a time when death-bed scenes were recounted for the purposes of pious instruction. Nicholas Culpeper met his end cheerfully, but Mrs. Culpeper was "in a great agony" and called out to him, " 'Sweet-heart, how canst thou be so chearful when grim Death looks thee in the face?' He, endeavouring to raise himself a little higher, said 'My dearest Girle,' (an expression he generally used) 'Live as I have done, and then thou wilt Dye as I do: for now I speak it, when it is no time to dissemble, In the presence of God and His Angels, I did by all persons, as I would they should do by me: I was alwayes just in my Practice: I never gave a Patient two Medicines when one would serve the turn. Farewel my Dearest, I am spent.' And so he exchanged this Life for a better."

So much for the recorded details of Culpeper's life. From the same source is drawn the following account of his physical appearance and character.

> Mr. Culpeper was in his Deportment gentle, pleasing, and courteous. His Complection darkish and swarthy. His Visage rather long than round. Of a presence not so beautiful as amiable. His Hair black and somewhat curling. His Eyes piercing. His Body a little above a *medium,* tending to tallness. Of a spare leane Constitution. In his Apparel not exceeding the moderation of one of his degree. Somewhat careless. He was of a clear and establisht Judgement. Of an eloquent and good Utterance. Of a quick Spirit, full of swift Thoughts and mounting. Of sparkling ready Wit, a Gift which doth not alwaies speak men Fortunate. He was sometimes too much overtaken with deep Speculations, though Melancholly was somewhat contrary to his nature, whatsoever he said otherwise of himself. . . . Of Religion he had a greater share than most Physicians use to have; he had so much Zeal as to hate Superstition, and he was no friend to Episcopal Innovations. . . . He was a person of so ready a minde, that he could more learnedly and suddenly dictate his Papers for the Press, than some that do take of the Lamp and the Oyl more studiously to contrive them. . . . His nature was both noble and honest. He was an excellent Companion, and for the most part of a merry temper. His mirth, as he was wont to say when he was far spent in his sickness, was the best Cordial he had left against the Consumption of

his Spirits. He was a dispiser of the World. A man confident, not jealous of his Fortunes, which the better enabled him to bear his misfortunes. . . . As he was so far from Covetousness that he cared not who was his Purse-bearer, so long as that he wanted not for necessary expences, he durst trust God's Providence with the rest: his Mind was surprized with higher mysteries than to stoop to such worldly trifles.

We are also told something of his practice which is quite at variance with that usually associated with a quack.

In his addresses to his Patients, he was not as some are, so arrogant to warrant their recovery: his usual advice was to bid them trust in God, and seek to him for a Blessing. He was none of those that used to put confidence in the single testimony of the Water, which as he used to say, "drawn from the Urine, is as brittle as the Urinal." . . . To the poor he prescribed cheap but wholesome Medicines, not removing, as many in our times do, the Consumption out of their bodies into their purses; not sending them to the *East Indies* for Drugs, when they may fetch better out of their own Gardens. Those that knew him rightly affirm that he was so Charitable to his poor Countrey-men that the money he received from rich persons he spread upon the waters, laid it forth for the good of those that were in want, though through his Charity he was sometimes necessitated: he would not perticipate of anything from the meaner sort of people, he onely desired their prayers. . . .

As he was an Apothecary formerly himself, so he discerned the errours of Apothecaries. . . . He used not to hansel his experiments, letting loose as some do their mad Receipts into sick men's bodies to try how well Nature can fight against them, as one writes, whilst they stand by and see the Battel, except it were in desperate cases, when death must be expelled; and when he could keep life no longer, he made an easie passage for it to go out. . . .

As to the extent of his practice, we are told that he regularly had 40 or so patients in a morning.

The volume in which these tributes to Culpeper first appeared was published five years after his death, a period brief enough for many to have recollections of the man and his practice but also long enough for the sense of loss to be assuaged and for cool reflection to correct the natural bias of those who were close to him. This volume was edited by William Ryves (or Reeves), who worked for many years as Culpeper's amanuensis and who tells us in his foreword that "in the time of my relation to him, I received more Knowledge and Light from him, than from all the Conversation I have since had either of Books or Men."

Throughout all Culpeper's writings there is a genuine and passionate concern for the sick poor. Much of the heat with which he expressed his views of the College of Physicians was engendered by this concern and the fact that the College, a very small and exclusive body, exercised a monopoly. It was a time when all

privilege and power was put in question and to Culpeper, whose reforming zeal extended to politics and religion as well as to medicine, it seemed that this monopoly put medical treatment beyond the reach of the poor. He states that in Italy at that time all physicians, no matter how exalted, had to treat whatever sick persons asked for their aid, and their fees was limited to the equivalent of 1s. 6d. (20 cents).

The education and training of physicians in seventeenth century England were little different from that of Culpeper himself. They attended Oxford or Cambridge for their classical or general studies and usually went to a foreign university to take a medical degree which was later incorporated in their own university at home. Their medical studies were almost entirely of a literary character and the books they studied were the same as those on which Culpeper founded his practice. There was little or no hospital teaching anywhere in Europe and the usual method of acquiring clinical knowledge and skill was to practise on patients. The remedies they employed were the same—mainly herbal preparations—which Culpeper used and advocated. What then marks off Culpeper as a "quack"? Was it his belief in astrology? But many, if not most, contemporary doctors—even Harvey—believed in astrology, as did the great majority of their patients. It is amusing to find that one of his quarrels with the College was not over their repudiation of astrology but their ineptness in employing it. The following is typical of his remarks:

> The College of Physicians of London laid all their heads together to hammer out the time when the Squill must be gathered, or taken out of the earth; and the result of all their consultations was this, That it must be gathered at the rising of the Dog-star, and so they very learnedly quoted it in that stately piece of Wit, their *Pharmacopoea;* but which of the two Dog-stars they mean, whether *Cyrius* or *Procyon,* or what rising, whether *Cosmical, Acronychal,* or *Heliacal,* I know not, nor I think themselves neither; for that a child in Astrology cannot chuse but admire at their learned ignorance.[2]

Culpeper's years of apprenticeship as an apothecary must have given him a more detailed understanding of the contemporary materia medica as prescribed and supplied to patients than could have been possessed by many physicians. His criticisms of contemporary treatment have been justified by later botanical knowledge, for little account was then taken of the difference between species of plants from different parts of the world, and the

[2] *Op. cit.*, p. 406.

prescription made up in London often resembled only in name that originally recommended by some classical or later foreign writer. It must also be remembered that the apothecary was, in fact if not yet in law, the poor man's physician by necessity. In a country with so few regularly qualified and licensed physicians it could not be otherwise. At that time and right up to the passing of the Medical Act of 1858 most medical practitioners in England entered practice by way of apprenticeship. Culpeper himself never pretended that he possessed a university degree in medicine. On the title pages of his books he styled himself "Student of Physick and Astrology," but never "Doctor." "Those that know me rightly," he wrote, "can determine that I was never so inamoured with that Title, but onely to inform my mistaken Countrey-men, that it is not the Cowl that makes the Munk, the shaking of the Urinal, the stroaking of the Beard, hard Words, the Plush Cloak, a large House with a Monster in the first Room to amaze the Patient, but deep grounded Reason, and tried Experience, that commences a Physician."[3]

Culpeper's political opinions are expressed forcibly in his books, and especially in the prefaces. They were brought to the notice of readers of this *Journal* by Cowen in 1956,[4] so that it is unnecessary to repeat them now. Referring to the translation of the *Pharmacopoeia Londinensis,* Cowen states that "Culpeper was not a member of the College and was not authorized to make a translation." In order to measure the extent of Culpeper's wrong against the College we must recall that the author (or authors) of *any* work had no legal rights in England; the printer had protection against piracy by virtue of its entry in the Stationers' Register as his copy. A translation from a foreign language was a new work and, even in normal times, it is very doubtful whether the College could have found any support in law for preventing the publication of Culpeper's translation, had they wished to do so. In the London of 1649 it would certainly have been difficult for them to have cited any privileges or rights granted to them by the recently executed sovereign or his predecessors. The translation was not a project undertaken by Culpeper on his own account, for we are told that "he was put upon it," although we are not told who in fact commissioned it. It is interesting to find that some years earlier Theodore de Mayerne, who had been concerned in

3 *Op. cit.,* p. 401.

4 David L. Cowen. "The Boston editions of Nicholas Culpeper," *J. Hist. Med.,* 1956, *11,* 156-165.

obtaining the charter for the Society of Apothecaries in 1617, had held, with others who were trying to get a charter for the Distillers, that the Apothecaries' charter was limited to the preparations in the *Pharmacopoeia Londonensis*. It seems likely therefore that Culpeper was doing a service to his fellow apothecaries by providing them with an English version of their official guide. Whatever criticism he levelled against the physicians while doing so is more than counterbalanced by the abuse of him and his work which was published in the royalist periodical *Mercurius Pragmaticus* in September 1649, where it was stated that the *Pharmacopoeia* was "done (very filthily) into English by one Nicholas Culpeper" who

> commenced the several degrees of Independency, Brownisme, Anabaptisme; admitted himself of John Goodwin's schoole (of all ungodlinesse) in Coleman Street; after that he turned Seeker, Manifestarian, and now he is arrived at the battlement of an absolute Atheist, and by two yeeres drunken labour hath Gallimawfred the apothecaries book into nonsense, mixing every receipt therein with some scruples, at least, of rebellion or atheisme, besides the danger of poisoning men's bodies. And (to supply his drunkenness and leachery with a thirty shillings reward) endeavoured to bring into obloquy the famous societies of apothecaries and chyrurgeons.

As Sir Sidney Lee, who cites this passage in his account of Culpeper in the *Dictionary of National Biography*, goes on to say, "The translation has none of the defects here attributed to it, and the abuse was obviously inspired by political opponents and the societies whose monopolies Culpeper was charged with having infringed."

As for the charge of atheism, it is clear that Culpeper was a zealous Puritan and his sincere religious belief is obvious throughout his writings. In this connection one need only refer to the dedication of his *Directory for Midwives* to "the Midwives of England," where he writes,

> The Creator of Heaven and Earth, the God of all the world, the great first being of all things, commits the life of every Child of his to your Charge, even to the very first minute that he allots it to draw its breath, and at your hands will he have an account of it another day. Oh! What manner of woman ought a Midwife to be? With what knowledge, skil, care, industry and sincerity ought she to perform her office? Let every honest Woman that takes this Charge upon her, take notice of it; and when she comes to deliver a Woman, let her know that for that day or night's work she must another day give account before Jehovah, the Lord Jesus Christ, and all the Angels.

Perhaps the last word—for the time being—may be left to Culpeper's contemporary biographer who wrote, "No man in his

time did stranger cures, so far as not only to cure men, but to cure the Art of curing men; to reform Physick itself, as many of the learnedest of the Colledge of Physicians have freely expressed; one of them being disposed to speak truth of him, said, That he was not only for Galen and Hypocrates, but he knew how to correct and moderate the tyrranies of Paracelsus."

CULPEPER'S BOOKS

Most of the publications bearing Culpeper's name as author or translator appeared after his death. It has been remarked, without supporting evidence, that the printers were probably exploiting his popularity by giving his name to many books with which he had nothing to do. Against this are the statements by his widow, who said that he left a great number of manuscripts behind him when he died and mentions the number "79 books." William Reeves, who served as Culpeper's amanuensis for many years, bears similar testimony. Culpeper was a good classical scholar and always an avid student. In order to make it worth his while to employ Reeves he must have been commissioned to make many more translations than appeared in his own lifetime. His declared intention was to present the public with the "whole body of Physick" in the English tongue, an intention which seems to be realised with the publication by Peter Cole of *The Physician's Library,* in which the translations in question appeared. As to the value of Culpeper's name, it is perhaps significant that many of these books were published after the Restoration, that Culpeper had been a notorious opponent of the King's cause and had written, in the very year of the King's execution (in his preface to *A Physicall Directory*), "God gave Tyrants in his Wrath, and will take them away in his Displeasure."

1649

1.

A Physicall Directory, or, A translation of the London Dispensatory made by the Colledge of Physicians in London. Being that book by which all Apothicaries are strictly commanded to make all their Physick. London, For Peter Cole, 1649. 4to. pp.[20]345[29]; port. front. Wing C7540.

A translation of the *Pharmacopoeia Londinensis* of 1618; 2nd ed. 1650, 3rd ed. 1651, each with a new preface. The latter contained for the first time, on pp. 139-184, "A Key to Galens Method of Physick."

1651

2.
A Directory for Midwives: or, A Guide for Women, in their Conception, Bearing, and Suckling, their Children . . . London: Printed by Peter Cole, 1651. 8vo. pp.[32]217[23]; port. front., 1 fldg. pl. Wing C7488.

This was reprinted 17 times, the last apparently in 1777.

3.
A Treatise of the Rickets: Being a Disease common to Children. . . . Published in Latin by Francis Glisson, George Bate, and Ahasuerus Regemorter. . . . Enlarged, Corrected, and very much amended throughout the whole Book. By Nich. Culpeper Gent. Student in Physick and Astrology. London: Printed by Peter Cole in Leaden-Hall, 1651. 8vo. pp. [8]373[5]; woodcut text figs. Wing G860.

There are two issues of this date, one without the name of Culpeper on the title-page. Reprinted 1668.

4.
Semeiotica Uranica. Or an Astrological judgement of diseases from the decumbiture of the sick; 1. From Aven Ezra by way of introduction. 2. From Noel Duret by way of direction. Wherein is layd down, the way and manner of finding out the cause, change and end of a disease. . . . To which is added the signs of life or death by the body of the sick party according to the judgement of Hippocrates. London, For Nathaniell Brookes, 1651. 8vo. pp.[14]190[10]; port. front. 2 plates (1 fldg.). Wing C7547.

The title of the 2nd ed. (1655) begins, "Culpeper's astrologicall judgement of diseases. . . ." Reprinted in 1658 and 1671.

5.
An Ephemeris for the year 1651. Amplified with Rational Predictions from the Book of the Creatures . . . To which is joyned, an Astrologo-Physical Discours of the Humane Vertues in the Body of Man. London: Printed by Peter Cole, [9 Jan.] 1651. 4to. pp. 32. Wing A1521.

1652

6.
The English Physitian: or an Astrologo-physical Discourse of the Vulgar Herbs of this Nation. Being a Compleat Method of Physick, whereby a man may preserve his Body in Health; or cure himself, being sick, for three pence charge, with such things only as grow in England, they being most fit for English Bodies. . . . London: Printed by Peter Cole, 1652. fol. pp. [16]255 (i.e. 159) [5]; port. front. Wing C7501.

This is the celebrated "Culpeper's Herbal." Two other editions appeared in the same year, a small 12mo with imprint "Printed for the benefit of the Commonwealth of England," which Culpeper repudiated as a piracy, and a

similar volume "Printed by William Bentley." More than 100 editions have been printed since, 15 of them before 1700.

7.
Galens Art of Physick: . . . Translated into English and largely Commented on. . . . London: Printed by Peter Cole, 1652. 12mo. pp.[24]120[8]; port. front. Wing G159.

A translation of Galen's *Ars Medica,* reprinted in 1662 and 1671.

8.
Catastrophe magnatum: or, the Fall of Monarchie. A caveat to Magistrates, deduced from the eclipse of the sunne, March 29. 1652. With a probable conjecture of the determination of the effects. London: T. Vere & Nath: Brooke, 1652. 4to. pp. [6] 76; illus. Wing C7458.

9.
An Ephemeris for the Year 1652, being Leap-Year, and a Year of Wonders. Prognosticating the Ruine of Monarchy throughout Europe. London: For T. Vere and N. Brook, 1652. 8vo. pp. 30. Wing A1522.

1653

10.
Pharmacopoeia Londinensis: or The London Dispensatory Further adorned by the Studies and Collections of the Fellows, now living of the Said Colledg. . . . By Nich. Culpeper. London: Printed for Peter Cole, 1653. fol. pp. [14] 325 (i.e. 217) [14]; port. front. Wing C7525.

This is a translation, with additions, of the second, revised, edition of the Latin *Pharmacopoeia Londinensis* published by the College of Physicians in 1650. It was pirated in 1654 "By a Well-wisher to the Common-wealth of England" and reprinted 14 times before 1718; the last edition, printed at Boston, Mass., in 1720 was probably the first medical book printed in the British colonies in North America. (See David L. Cowen, "The Boston editions of Nicholas Culpeper." *J. Hist. Med.,* 1956, *11,* 156-165).

11.
An Ephemeris for the year of Our Lord 1653. . . . London, By John Macock for the Company of Stationers, 1653. 8vo. pp. 32; port. front. Wing A1523.

Similar almanacs were printed by Macock for 1654, 1655, and 1656, but as Culpeper was dead, the attribution to him must be spurious.

12.
The Anatomy of the Body of Man: Wherein is exactly described every part thereof, in the same Manner as it is Commonly shewed in Publick Anatomies. . . . Published in Latin by Joh. Veslingus . . . and Englished by Nich. Culpeper. London: Printed by Peter Cole in Leaden-Hall, 1653. fol. pp.[16]192 (i.e. 92) [96]; engr. plates. Wing V286.

The last 96 pp. in the collation consist of 24 plates and their explanatory legends. The work is translated from the Padua (1647) edition of Vesling's *Syntagma Anatomicum,* and was reprinted in 1677.

1654

13.
Opus astrologicum, &c. or an Astrological work left to posterity. Briefly containing, 1. A century of aphorisms. . . . 2. Elections astrological, for such as are going to war. 3. Elections and observations concerning journeys. 4. Elections for buildings. . . . 5. Prognostications, and astrological secrets, etc. London: J. Cottrel for Ri. Moone & Steph. Chatfield. 1654. 8vo. (unpaged). Wing C7524.

14.
A New Method of Physick: or, a Short View of Paracelsus and Galen's Practice; in 3. Treatises. . . . Written in Latin by Simeon Partlicius . . . Translated into English by Nicholas Culpeper . . . London, Printed by Peter Cole in Leaden-Hall, and are to be sold at his Shop . . . And by S. Howes, J. Garfield, and R. Westbrook. 1654. 8vo. pp.[18]548 (i.e. 348). Wing P612.

15.
Physicall and Chymicall Works, composed by Geor: Phaedro . . . Selected out of the Germane and Latine Language; By the industry of John Andreas Schenckius of Graffenberg. . . . London, Printed for William Sheares, 1654. 8vo. pp.[16]133. Wing P1955.

This was re-issued in 1656 with a cancel-title reading: "Culpepers Physical and Chymicall Way of Curing the most difficult and Incurable Diseases. With a Catalogue of the Cures performed by the Rare Medicaments of George Phedro, a famous Physitian. Selected out of the Germain and Latine Authors, and now published for the Common Good. London, Printed for William Shears Junior, 1656." Wing P1956. It was again reprinted with the title "The Art of Chymistry" in 1674.

1655

16.
Culpeper's Last Legacy: Left and bequeathed to his dearest Wife, for the publicke good . . . Containing Sundry admirable Experiences in severall Sciences, more especially, in Chyrurgery and Physick . . . Printed for N. Brooke at the Angell in Cornhill, 1655, 8vo. pp. [8]48[4], 73[6]144 (i.e. 140); port. front. Wing C7518.

Contents: A treatise of the head; Febrilia; Physical aphorisms; Treatise of the pestilence; Composita; Aphorisms; Select aphorisms; Select medicinall aphorisms. (Each with separate t.p. except the first and third.) There were 9 editions, the last in 1702.

17.
The Practice of Physick, in Seventeen several Books. . . . By Nicholas Culpeper, Abdiah Cole, and William Rowland. Being chiefly a Translation of the Works of Lazarus Riverius . . . London: Printed by Peter Cole, 1655. fol. pp.[16] 645 [17]; port. front. (of Rivière, Culpeper, Cole, and Rowland.) Wing R1559.

The last 8 leaves consist of "A Physical Dictionary," with separate t.p. Reprinted ("in twenty and four books") in 1661, 1663, and 1665 as part of "The Physician's Library"; and again in 1668, and 1678.

1656

18.
Two Books of Physick: viz. 1. Medicaments for the Poor; or, Physick for the Common People. . . . First written in Latin by . . . John Prevotius . . . Translated into English, and something added, By Nich. Culpeper. . . . II. Health for the Rich and Poor, by Diet without Physick. By Nich. Culpeper. . . . Also Culpepers Ghost [by Peter Cole?], is hereunto added; being a Book of Truth, Wit, and Mirth. London: Printed by Peter Cole, 1656. 8vo. pp.[24] 388 [6] 41 [8] 16; port. front. Wing P3328 [+ 3324]. Each part, including the first, has separate t.p. and pagination. Reprinted in 1662, 1664 (Edinburgh), and 1670.

1657

19.
Mr. Culpepper's Treatise of Aurum Potabile. . . . Containing the Knowledge necessary to the Study of Hermetick Philosophy. Faithfully written by him in his Life-time, and since his Death, published by his Wife. London, Printed for George Eversden, 1657. 8vo. pp. [16] 193 [7]; port. front. Wing C7549.

20.
The Idea of Practical Physick in Twelve Books. . . . Written in Latin by John Johnston . . . And Englished By Nich. Culpeper . . . and W.R. London, Printed by Peter Cole, 1657. fol. pp. [20] 26 (i.e. 29), 15, 37, 11, 16, 42, 71, 26, 42, 71, 26, 89, 10. [1]. Wing J1018.

21.
The Expert Doctors Dispensatory. The Whole Art of Physick restored to Practice. . . . To which is added by Jacob A. Brunn, . . . a Compendium of the Body of Physick . . . by . . . P. Morellus. London, Printed for N. Brook, 1657. 8vo. pp. [32] 471 [9]; engr front. Wing M2719.

Culpeper is usually credited with this translation, but his signed "approbation" at the beginning implies that it was the work of another. Von Brunn's work has a separate t.p., "The Physicall Magazeen," following p. 279, but pagination is continuous.

22.
A Sure Guide; or, The Best and Nearest Way to Physick and Chyrurgery. . . . Written in Latine, by Johannes Riolanus, Junior . . . Englished by N. Culpeper . . . and W.R. London: Printed by Peter Cole, 1657 fol. pp. [12] 288 [12] [96]; engr. plates. Wing R1525.

The 96 pp. at end consist of 24 plates and their explanatory legends. Reprinted in 1671.

1658

23.
Four Books of that Learned, and Renowned Doctor, Lazarus Riverius. Containing Five hundred and thirteen Observations, or Histories, of Famous and Rare Cures . . . Unto which is added, A Fift Book, being Select Medicinal Counsels of John Fernelius . . . All Englished By Nicholas Culpeper. London, Printed by Peter Cole, 1658. fol. pp. [16] 463 [24]. Wing R1555.

Re-issued, with same t.p., in the 2nd ed. of the same author's *Practice of Physick,* 1661.

1659

24.
Culpeper's School of Physick. Or the Experimental Practice of the whole Art. By Nich. Culpeper . . . The Narrative of the Authors Life is prefixed, with his Nativity Calculated, together with the Testimony of his late Wife, Mrs. Alice Culpeper, and others. London, Printed for N. Brook, 1659. 8vo. pp. [56] 361 (i.e. 461) [26]; port. front. Wing C7544.

Contents: Culpeper's School of Physick, or The English Apothecary; Fragmenta Aurea; The Chyrurgeon's Guide; The Treasury of Life; The Expert Lapidary; Doctor Diet's Directory; Doctor Reason and Doctor Experience; Chymical Institutions. Each has separate t.p. Reprinted in 1678 with three variant imprints: viz., "For O.B. and R.H. and to be sold by Robert Clavel"; "Printed for Obadiah Blagrave and to be sold at his shop . . ."; and "Printed for R. Harford, and are to be sold at his shop. . . ."

Reprinted in 1696 and (pt. vi only) 1933.

25.
Thirteen Books of Natural Philosophy . . . Written in Latin and English. By Daniel Sennert, Nicholas Culpeper, Abdiah Cole. London: Printed by Peter Cole, 1660. fol. pp. [20] 224 (i.e. 410); port. front. (Sennert). Wing S2544.

Reprinted in 1660 and 1661.

1660

26.
Two Treatises. The First of the Venereal Pocks . . . The Second Treatise of the Gout . . . Written in Latin and English By Daniel Sennert, Nicholas

Culpeper, Abdiah Cole. London: Printed by Peter Cole, 1660. 8vo. pp. [2] 75, 87. Wing S2547.
Reprinted in 8vo in 1673.

27.
Arts Master-piece: or, The Beautifying part of Physick. Whereby all defects of Nature in both Sexes are amended . . . Never before extant, though long since promised by Mr. Nic. Culpeper, but now published by B.T. Doctor in Physick. London: for Nath. Brook, 1660. 8vo. pp. 140. Wing W1234.
Translated from the Latin of H. J. Wecker.

1662

28.
Two Treatises. The first of Pulses, The second of Urines, By John Fernelius, Abdiah Cole, and Nich. Culpeper. London: Printed by Peter Cole, 1662. 8vo. pp. [8] 80. Wing F808F.

29.
A Golden Practice of Physick. In Five Books, and Three Tomes. . . . By Felix Plater . . . and R.W., Abdiah Cole, Nich. Culpeper . . . Unto which is added two excellent Treatises [by D. Sennert]. 1. Of the French Pox. 2. Of the Gout. London: Printed by Peter Cole, 1662. fol. pp. [10] 688; woodcut text figs. Wing P2395. (N.B. 2394 is a "ghost.")
There is an additional t.p. at front for "The Physitians Library."

30.
Experimental Physick. Or, Seven Hundred Famous and Rare Cures. Being Part of The Physitian's Library. . . . By Nich. Culpeper and Abdiah Cole. London: Printed by Peter Cole . . . for E. Spurdance. 1662. 8vo. pp. [24] 736 [16]. Not in Wing.
There are actually "ten centuries" of cures, the greater part of them taken from Martin Ruland.

31.
Chymistry made Easie and Useful . . . By Sennertus, [translated by] N. Culpeper and A. Cole. London: Peter Cole, 1662. 8vo. pp. [10] 166. Not in Wing.

32.
Practical Physick; the First [-Second, -Third] Book. London: Peter Cole, 1662. 8vo. pp. [22] 402; pp. [16] 158 [2]; pp. [36] 423. Wing S2539, 2540. The third book is not in Wing.

33.
—— The same. The Sixth Book. London: Peter Cole, 1662. 8vo. pp. [20] 108. Not in Wing.

1663

34.
Bartholinus Anatomy . . . in four books . . . published by Nich. Culpeper and Abdiah Cole. London: Peter Cole, 1663. fol. pp. [12] 377 [i.e. 373] 4 engr. pl. (pp. 171-300 wanting). Wing B976.
Reprinted in 1668.

35.
Two Treatises: the First of Blood-letting; the Second of Cupping and Scarifying, and the Diseases to be cured thereby. By N. Culpeper, M. Ruland, and A. Cole. London: Peter Cole, 1663. 12mo. pp. [8] 140 [8]. Wing C7550.
A "third" edition was printed in 1672.

36.
The Art of Chirurgery Explained in Six Parts . . . Being the whole Fifth Book of Practical Physick. By Daniel Sennertus: [translated by] R.W., Nicholas Culpeper, Abdiah Cole. London, Peter Cole and Edward Cole, 1663. fol. pp. [2] 2401-2687. Wing S2531.
The pagination suggests that this was part of a complete folio edition of *Practical Physick* with continuous pagination.

1664

37.
Practical Physick: the fourth book. London: Peter Cole, 1664. 8vo. pp. [18] 270. Wing S2541.

38.
Platerus Histories and Observations Upon most Diseases offending the Body and Mind, Hurt of Functions, Pain, or Troubles and Infirmities: in Three Books. In the same Order and Method, and Number of Books as his *Golden Practice*. . . . By Felix Plater, [translated by] Nich. Culpeper, And Abdiah Cole. London: Printed by Peter Cole, 1664. 8vo. pp. [8] 557 [21]. Not in Wing.

The Libraries of Rome in the *Iter Italicum* (1765) of Domenico Cotugno*

DOROTHY M. SCHULLIAN**

IN 1754 a young man of 18, native of Ruvo di Puglia and from early years devoted to the medical sciences, was serving as medical assistant in the historic Ospedale degli Incurabili in Naples. It was scarcely a healthful post: the air was often poor, he was of necessity repeatedly present at autopsies, his sleep was continually interrupted, and from lack of funds he was limited to a scanty and improperly balanced diet. There is little doubt that these factors, in combination with his eagerness to apply himself day and night to the observation and treatment of disease, would eventually have affected his own health had not the directors of the hospital become aware of the danger in time and done everything possible to relieve the situation. They assigned him a better room, for example; they raised his monthly stipend; and in order to spare him the necessity of buying expensive medical books, they granted him permission—a permission then very rare and particularly coveted—to use the hospital's library at any hour whatsoever.[1]

It is probable that this circumstance was influential in fostering the love for books and libraries which throughout his life was a joy and almost an act of faith for Domenico Cotugno. Once in possession of the keys to the hospital's library he spent there, as he was wont to say later, the happiest days of his life.[2] There he perused the medical books from which he took the first steps toward

* It has seemed that a paper concerned with an Italian physiologist and bibliophile of the eighteenth century might honor fittingly the memory of an American physiologist and bibliophile of the twentieth century who had a particular love for Italy. The paper was originally delivered in Italian before the Convegno Internazionale di Storia delle Biblioteche, Cesena, 3-7 October 1954, and has been translated and adapted here by permission of the authorities of that Convegno.

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1 *Atti del R. Istituto d'Incoraggiamento alle scienze naturali di Napoli*, ser. I, 1834, 5, 326. A catalogue of this library, *Index librorum Bibliothecae Regii Napoletani Incurabilium Archinosocomii MDCCLXIII*, is contained in a miscellany of printed works preserved at the Biblioteca Nazionale in Naples under the collocation 101.F.40.

2 Scotti, Angelo Antonio, *Elogio storico del cavalier D. Domenico Cotugno*, Napoli, 1823, p. 14. According to an anonymous biography which forms part of the miscellany MS. XXII.A.8 in the Biblioteca di Storia Patria in Naples, f.175v, the days were happy for Cotugno because he practised and repeated to the students the lessons which he himself learned each day. This biography was published by A. Jatta in the volume *Onoranze cittadine rese a Domenico Cotugno nel giorno 6 ottobre 1891 apponendosi una lapide commemorativa alla casa ove nacque*, Ruvo di Puglia, 1893, pp. 93-97.

the renown which is his today in the history of Italian and universal medicine. He went on to make important anatomical discoveries, to serve as professor of anatomy in the University of Naples, to attend the members of the royal house, and to hold memberships in numerous Italian and foreign academies. He reached the heights, therefore, in the medicine of his day, and all the while he was cultivating the humanities with equal zeal. One need only consult the catalogue of his own magnificent library[3] to appreciate the breadth of his interests: medicine held first place, of course, but his library contained also many works of classical authors and a large selection of editions of the fifteenth and sixteenth centuries. He was a true bibliophile, and he had always an immense esteem for both medical and general libraries.

Cotugno died on 6 October 1822 at the age of 87. The books which he had collected with such patience for so many years were partially scattered; some are tragically missing, some were stolen. A large number, however, found in the Biblioteca Nazionale of Naples a welcome worthy of their value and a home which will shelter them for historians and bibliophiles of the future. Among them is the autograph manuscript[4] in which Cotugno relates, in the form of a diary, and therefore in a Latin not outstanding for

3 *Catalogo di una biblioteca vendibile*, Napoli, 1828, designated hereafter simply *Catalogo, 1828*.

4 XII.G.64, 79 fol. The manuscript, consigned by Pietro Cotugno, nephew of Domenico, to Pietro Ruggiero, professor of general pathology at the University of Naples, belonged afterward to Ruggiero's son, Francesco Paolo Ruggiero, Minister of Finance in 1848-1849, from whose library it passed to the Nazionale; see Domenico Cotugno, *Opera posthuma*, cura et studio Petri Ruggiero, Napoli, 1830, *1*, p. v; *Catalogo di una scelta biblioteca da vendere . . .*, Napoli, 1873, *1*, p. 163; and *Biblioteca Ruggiero, Liste dei prezzi*, Napoli, [1875], p. 11. It was amply described and summarized, especially for the section concerning Morgagni and with quotation of numerous passages, by Luigi Messedaglia in *Atti del R. Istituto Veneto di scienze, lettere ed arti*, 1913-1914, *73*, Pt. II, 1691-1803, whose article has helped me at various points. With the approval of Messedaglia (died 7 February 1956) Prof. Luigi Belloni and I have undertaken a definitive edition of the *Iter Italicum* with Italian and English translations and commentary; Professor Belloni has already issued a diplomatic text (in Domenico Cotugno, *Iter italicum anni MDCCLXV*, edito da Luigi Belloni, 1960, 93 pp. [*Memorie dell'Istituto Lombardo—Accademia di Scienze e Lettere*, Classe di Lettere, Scienze Morali e Storiche, vol. *27*, II della Serie IV]), and I presented at the Symposium Internazionale di Storia della Neurologia, Varenna, 30 August-1 September 1961, a paper entitled "Domenico Cotugno as Humanist" which was largely based on this diary and which will be published in the Proceedings of that symposium. References to the manuscript diary, cited in this paper by folio number, can be readily consulted in Professor Belloni's diplomatic edition. By the kindness of Gennaro de Gemmis and the Archivio Provinciale de Gemmis at Bari scholars now have available also Cotugno's account of his trip to Vienna in 1790, *Uno scritto inedito di Domenico Cotugno: Iter Neapoli Viennam Austriae anno 1790*, Bari, 1961 (*Fascicoli dell'Archivio Provinciale de Gemmis*, I).

My thanks are due to Professor Belloni for assistance rendered me at many points; Professor Augusto Campana, President of the Commission for the 1954 Convegno cited above; the lamented Angelo Mercati, formerly Prefect of the Archivio Vaticano; Monsignore Giuseppe Monticone, Archivista Generale of the S. Congregazione De Propaganda Fide; and Dott.ssa Guerriera Guerrieri, Direttrice of the Biblioteca Nazionale of Naples. The original work on this paper was done with the aid of a Fulbright Research Grant.

elegance, the trip which he made in the spring of 1765 to visit at Padua the reigning dean of Italian medicine at that time, Giambattista Morgagni of Forlì.

Cotugno was then 29 and "rich in intellect, in hopes, and in energy, and already known to the world of scholars for his classical dissertations on the internal ear and on sciatica."[5] One could rightfully expect of him an abundance of details on medicine and other disciplines for the cities which he visited, and he did not disappoint. Since he was already a bibliophile, he naturally seized the opportunity to stop at libraries both public and private, and he informs us on those in Rome, Pesaro, Padua, Venice, Florence, and Montecassino. He visited Rome on the way to Padua and also on the return trip. On both occasions he was remarkably fortunate in the librarians who showed him their treasures, so much so, indeed, that this article could well be entitled "The *Librarians* of Rome in the *Iter Italicum* (1765) of Domenico Cotugno." Among them—and I intend the word librarian in its original and most liberal meaning, a man, that is, who is in any way at all associated with a collection of books—the most outstanding was the physician Natale Saliceti of Nebbio in Corsica, who for seven years had been professor of surgery and anatomy in the University of Rome and ten years later was to become physician to Pius VI, Braschi. His renown as the most eminent physician of the city was such that it seemed if you did not have him "you would not be certain of getting well and there was no further resource when death threatened."[6] He deserves the title of librarian because he collected a very choice library and even in his old age never ceased adding to it rare books in every discipline. The story went (and it was easily true) that the expense was stupendous, to the point even that he had to deprive himself of some of life's conveniences, but he generously granted free access to his library "to whoever was presented to him, permitting not only friends but anyone at all to borrow books, even for a long time."[7] It was with good reason that

5 Messedaglia, p. 1697: "ricco di intelletto, di speranze e di attività, e noto ormai al mondo degli studiosi per le sue classiche dissertazioni sull' orecchio interno e sulla ischialgia."

6 Renazzi, Filippo Maria, *Storia dell' Università degli Studj di Roma*, Roma, 1806, *4*, p. 260: "o che guarir con fiducia non si potesse, ovvero morire senza ulteriore risorsa."

7 Pasqualoni, Pietro, *Delle lodi di Monsignor Natale Saliceti, Archiatro Pontificio. Orazione recitata nell' Archiginnasio della Sapienza, il dì 7 luglio 1789*, Roma, 1789, p. 23: "a chiunque gli si fosse presentato, permettendo non solo agli amici, ma a chicchessia ancora l'estrazione de' libri per lungo tempo." Juan Andres in his *Cartas familiares . . . a su hermano D. Carlos Andres, dandole noticia del viage que hizo a varias ciudades de Italia en el año 1785*, Madrid, 1786, *1*, pp. 183-184 also praises the library and the generosity of Saliceti: "No pude ver la riquisima libreria que Monseñor Salicetti, Médico del Papa, tiene en el Vaticano; porque como entonces habitaba S. S. como lo scostumbra

his two sisters mentioned the library in his epitaph in the church of San Luigi de' Francesi,[8] and his name will run as *Leitmotiv* through the pages of this article on Roman libraries.

Saliceti was chief physician at the Ospedale di Santo Spirito. One can imagine with what satisfaction he made the acquaintance of a young man already far advanced on the two paths which for so long had been also his, medicine and bibliophily. He talked with Cotugno on many subjects of common interest, among them the rich medical library given to Santo Spirito in 1714 by Giovan Maria Lancisi.[9] The Lancisiana contained then, and contains today, three volumes of letters of Lancisi which Saliceti intended to publish. It is not clear from the *Iter Italicum* whether in the midst of his numerous duties Saliceti was able himself to show the Lancisiana to Cotugno, but it is certain that Cotugno visited there and that he saw manuscripts of Antonio Leprotti, who had been Saliceti's teacher; 22 volumes of the Studi Juvenili of Lancisi, with autographs of his printed works; and (a collection particularly gratifying to a Neapolitan physician) autographs of Marco Aurelio Severino which had come to the Lancisiana from the library of the physician G. B. Guarnieri of Naples[10] (f.12v).

The friendship cemented on this occasion between Cotugno and Saliceti lasted until the latter's death. In a letter of 27 July 1778,[11] for example, he recommended to Cotugno in Naples a Polish physician whom he knew. In another,[12] undated, he asked his advice on a patient. In a third,[13] dated 2 June 1786 and written

en los meses de verano, en el Palacio de Monte-Cavallo, no teni allí á mano Monseñor sino algunos de sus libros, que quiso mostrarme, y aun me hizo el favor de prestarme algunos de ellos. Ofreció llevarme un dia al Vaticano á ver los otros; pero sus muchas ocupaciones, y mi viage á Napoles no permitieron que llegase aquel dia, que para mi hubiera sido de sumo gusto, y me lo hacian desear mas los libros que ví en Monte-Cavallo. Una de las cosas que hacen recomendable esta libreria es que abunda de libros de ciencias naturales, de los que comunmente estan faltas todas las de Roma, y tiene tambien otros muchos costosos y raros por las láminas, y otras particularidades, que aumentan su valor y raridad."

8 Forcella, Vincenzo, *Iscrizioni delle chiese e d'altri edificii di Roma*, Roma, 1873, 3, p. 56, no. 144.

9 *Iter Italicum*, f. 11. References to this diary will hereafter be incorporated into the text simply by folio number.

10 See Modestino Del Gaizo in *Bollettino della R. Accademia Medico-Chirurgica di Napoli*, 1891, 3, 77.

11 Naples, Biblioteca Nazionale, MS. San Martino 395, f. 218.

12 MS. San Martino 399, ff. 91-92r.

13 MS. San Martino 395, ff. 477-478: ". . . prima di quel triste giorno *Che l'umana miseria suol far breve*. . . . O quanto mai gradirei ch'ella il vedesse con que' suoi occhi sì lucidi, sì penetranti, e sì fini conoscitori di ciò, che è raro nell' arte nostra, nella storia naturale, nell' antiquaria, e nelle belle lettere. Si è dato il felice incontro della vendita di una celebre libreria del fù Cardinale Marefoschi, ove ò trovati de' pezzi rari, che mi àn rallegrato. In autunno ne sarà pure dispersa un' altra, che appartenne a Casa Conti, dalla quale ò però in addietro potuto avere delle opre insigni, e tra le altre il corpo intero dell' orto Malabarico, a dì nostri preziosissima gemma, e che non può più trovarsi. È questa in somma una vecchia mia passione, ed or la considero come la tavola del naufragio nella vecchiaja."

when he was himself ill, he expressed the hope of being able to see his beloved Cotugno again "before that sad day *Che l'umana miseria suol far breve*" [Petrarca, *Son.* 25, v.2]. "Oh how happy I should be," he adds, speaking of his museum, "if you could see it with those clear and penetrating eyes of yours which know so well what is rare in our art, in natural history, in antiquities, in belles-lettres." And because he remained a bibliophile even when old and ill, he gave to Cotugno the latest news on book sales:

> I've had a bit of good luck from the sale of the famous library of the late Cardinal Marefoschi,[14] where I found some rare items which greatly cheered me. In the autumn another will be sold, which belonged to the Conti shop,[15] from which however I was able some time ago to obtain some remarkable titles, including a complete set of the *Hortus malabaricus*,[16] a very precious gem in our time and no longer to be found. This book collecting is in short an old passion of mine, and now in my old age it is serving me like the plank to which the shipwrecked voyager clings.

It is very probable that he saw Cotugno again in Rome in 1788 and that they talked of rare books. Saliceti died on 21 February 1789.

In the spring of 1765 Cotugno spent long hours talking of rare books with another illustrious professor of the Sapienza. The Abbot Girolamo Fonda,[17] priest of the Ordine delle Scuole Pie and reader in philosophy and mathematics at the Collegio Naza-

[14] Cardinal Mario Marefoschi, of Macerata, died at Rome 23 December 1780. Clement XIII had named him in 1759 Secretary of the Sacra Congregazione De Propaganda Fide, where he amassed a renowned library. He was created cardinal in 1770, and in the Holy Year 1775 he opened and closed the Porta Santa at the basilica of S. Giovanni in Laterano. See Gaetano Moroni, *Dizionario di erudizione storico-ecclesiastica*, 1847, *42*, p. 270, and Forcella, *op. cit.*, 1876, *8*, p. 92, no. 254. Saliceti mentioned the library of Marefoschi in a letter from Rome, 18 October 1783, to Gaetano Marini (Vat. lat. 9057, f. 278r): "Quì ancora siamo incerti del destino della Libreria Marefoschi aggiudicata nella Gran Segnatura dal Papa al Fratello del Cardinale. Finora non vi è presentato veruno per farne acquisto. Non è deciso, se dovrà vendersi a pezzi, oppure intera. Sarà ben grande la difficoltà di trovar persona, che voglia fare uno sborso, e portarsela a casa tutta in un corpo." See also Vat. lat. 9051, f. 200v (Francesco Saverio Gualtieri to Marini, Naples, 26 June 1786); Andres, *op. cit.*, *1*, 183, who says: "Non te hablaré de la biblioteca . . . del defunto Cardenal Marefoschi, que estaba y está aun vendible, y que segun dicen es copiosa y selecta"; *Bibliothecae Marii Compagnonii Marefusci S. R. E. Cardinalis catalogus* (Publice prostabit Romae Anno MDCCLXXXVI. Administrante venditionem Iosepho Antonio Monaldinio); and *Catalogo della maggior parte della biblioteca della chiara memoria dell' eminentissimo cardinale Mario Compagnoni Marefoschi*, Roma, Presso Giuseppe Antonio Monaldini, 1787.

[15] The bookshop Casa Conti was located at this time near the Trevi Fountain. See for example *Nuovo catalogo di libri diversi della libreria dell' eccellentissima Casa Conti*, Roma, Antonio Fulgoni, 1792.

[16] *Hortus indus malabaricus* adornatus per Henricum van Rhede Drakenstein, Io. Lascarium, Io. Muniks, & Theodorum Iansson ab Almeloveen; notis & comment. illustrat. a Io. Commelino . . . , Amstelodami, 1686-1703, 13 vols., "opus . . . auro contra carius, tantaeque nunc raritatis, vix ut spes ulla supersit, fore illud deinceps in privatis Bibliothecis inveniendum," see Pt. I, pp. 53-54, of the *Catalogo della biblioteca della ch. me. di Monsignore Natale Saliceti Archiatro di N. S. Papa Pio VI*, Roma, 1789 (Si vende al negozio di Mariano di Nicola de Romanis Libraro a S. Pantaleo per paoli tre).

[17] Renazzi, *op. cit.*, 1806, *4*, pp. 266-269 and Moroni, *op. cit.*, 1857, *85*, p. 90.

reno, had already published a book on civil and military architecture.[18] Later at the University he held for many years the chair of experimental physics, and it was under his direction that the famous lightning rods were erected at the corners of the Palazzo della Sapienza.[19] He met Cotugno on his first visit to Rome, and they talked of anatomical matters (ff.15v-16r); on the return trip he discoursed at length (ff.74v-75) on two book collectors. The first of these was a true bibliophile: the library of Cardinal Guglielmo Sirleto, inherited in part from Cardinal Marcello Cervini and later conveyed in part, through Cardinal Ascanio Colonna and the duke Giovanni Angelo d'Altemps, to the Vaticana,[20] had been renowned even in the sixteenth century. Fonda mentioned among its holdings early editions of Cicero and St. Augustine and a Vergil published by Aldus Manutius[21] which survived in only a few copies because schoolchildren had worn to pieces so many. Sirleto's copy, in fact, displayed in the margins notes in a childish hand.

The second collector of books was condemned by Fonda. It would appear that like some collectors today he amassed a library without ever reading the books which it contained. His name was Andreozzi, and he was a rich Roman merchant who at an already advanced age conceived the desire of establishing a Biblioteca Andreozziana. As a man of affairs accustomed to realizing his aims with promptness and efficiency, he called in a carpenter and gave orders for the construction of book shelves. The carpenter requested measurements; Andreozzi replied that measurements were not needed, that it was sufficient to construct handsome shelves of various measurements. When the shelves were finished he purchased for eight thousand scudi the library of a cardinal who had recently died, ordered that the books be put into French bindings, and directed that they be lined up on the shelves in such a manner

18 *Elementi di architettura civile e militare ad uso del Collegio Nazareno,* Roma, Mainardi, 1764, 2 vols.

19 Renazzi, *loc. cit.*, who relates his part in persuading "i Superiori, acciocchè si effettuasse una sì necessaria operazione. Perchè una volta dando lezione, se non ero lesto ad interromperla, e partirmene colli Scolari, cadde poco dopo un fulmine, e trisciando per la Sala dei Lettori con non lieve danno delle pareti, andò a svanire nel sottoposto Albergo." Fonda published a tract *Sopra la maniera di preservare gli edifici dal fulmine,* Roma, Giunchi, 1770.

20 Dorez, Léon, Recherches et documents sur la bibliothèque du Cardinal Sirleto, *Mélanges d'archéologie et d'histoire de l'Ecole française de Rome,* 1891, *11,* 457-491. Here, as elsewhere, I have often found useful Carlo Frati, *Dizionario bio-bibliografico dei bibliotecari e bibliofili italiani,* Firenze, Olschki, 1934 (Biblioteca di Bibliografia Italiana diretta da Albano Sorbelli, *13*).

21 Perhaps the edition of 1514, rare also today.

that they would all be of the same height for the various measurements. But even he soon became aware that there is much diversity in the height of books. He solved the problem easily, however: the smaller books were put into taller covers, the upper and lower margins of the larger ones were cut down, and when necessary even two or three lines of text were sacrificed. By these means his volumes became all of the proper height, they could be well ordered on the shelves, and his library presented a fine appearance to anyone who did not actually consult its books.

I should not wish to judge too severely this mistaken zeal of Giovanni Paolo Andreozzi. Even librarians can understand, if they cannot approve, his motives, and perhaps some things may be pardoned him in view of the generosity which he displayed in his will. He died in 1752 at the age of 93 and was buried in the nave of Santa Maria d'Aracoeli.[22] Inscriptions at Santissima Trinità de' Pellegrini[23] attest his liberality toward that archconfraternity, but his principal heir was the Collegio di Propaganda Fide, which in gratitude set a marble bust of him above the old entrance to its library. Beneath one reads,[24] without surprise, that the wealth of Andreozzi was surpassed only by his piety. His books therefore went to the Piazza di Spagna to take their place beside many others bequeathed to the Collegio by high functionaries of the Church.[25] The old library was taken by the Republicans and there were additional vicissitudes later, but some of Andreozzi's books may still exist in the Collegio or in the Seminario di Propaganda Fide on the Janiculum.

The professor of Oriental languages at the Collegio di Propaganda Fide was for many years librarian at the Vaticana. In 1765 Giuseppe Simonio Assemani had reached the age of 78. A half century had gone by since on the orders of Clement XI he journeyed to the Orient in search of manuscripts, but he continued to work on his catalogues[26] and to conduct visitors through the Vaticana. Perhaps Natale Saliceti had already spoken to him of Cotugno; at any rate, Cotugno was able to enter the Vaticana with-

22 Forcella, *op. cit.*, 1869, *1*, p. 265, no. 1007. The inscriptions cited in the following notes make him 94.

23 Forcella, *op. cit.*, 1876, *7*, p. 222, no. 465 and p. 245, no. 495.

24 Forcella, *op. cit.*, 1877, *11*, p. 461, no. 686.

25 On the library of the Collegio see Moroni, *op. cit.*, 1842, *14*, pp. 234-235.

26 Cotugno owned the *Catalogo della Biblioteca Chigiana*, published the preceding year by Stefano Evodio Assemani, nephew of Giuseppe Simonio, and of Giuseppe Simonio he had the work *Italicae historiae scriptores*, Roma, 1751-1753, 4 vols.; see *Catalogo, 1828*, p. 20.

out difficulty and does not complain, as did the Spaniard Juan Andres twenty years later, that the treasures of the Vaticana were jealously barred to scholars, the catalogues in poor order, the collocations not always exact, the employes too well paid and often lazy, and that the Vaticana was in short a tomb instead of a treasury of books.[27] For Cotugno, indeed, circumstances were quite the reverse. He made, as did Andres, two visits. On the first (f.73r) he saw, as did Andres, the usual things: the illustrated manuscript of Terence,[28] a Dante,[29] an autograph of Petrarch on very rough hempen paper, corrected at various points and scarcely, at least to Cotugno, intelligible.[30] It would appear that Cotugno made this visit without Assemani; in the second, however, of which I shall speak later at greater length; he asked the prefect if he might see a medical manuscript, and he obtained permission at once. Whether he also made on either visit the acquaintance of the prefect of the Archivio Vaticano, Giuseppe Garampi of Rimini, is not clear from his account. It is certain, however, that near the end of the eighteenth century the five volumes of the sale catalogue of the extensive library of Cardinal Garampi[31] were on his shelves in Naples, and a search among his books might disclose some purchased from this catalogue.

The Vaticana of 1962 contains many treasures which in 1765 Cotugno saw at the Piazza Barberini beside Bernini's great Triton. The librarian of the Barberiniana at this time was the Abbot Simone Ballerini, born in Rome of a family which had its origins in Pesaro.[32] In view of the anatomical work on sneezing on which Cotugno was engaged at least from the year 1763,[33] it is of interest to recall that Ballerini had also occupied himself with this phenomenon, if from another point of view; his contribution, published at Rome in 1757, is entitled *Origine dell' uso di salutare quando si sternuta*, and the two may have talked of this common interest as they examined the rarities in the magnificent palace on

27 Andres, *op. cit.*, 1, pp. 163-169 and Agata Lo Vasco, *Le biblioteche d'Italia nella seconda metà del secolo XVIII*, Milano, 1940, pp. 5 ff.

28 See *Terentius*. Codex Vaticanus latinus 3868 picturis insignis, ex auctoritate procuratorum Bybliothecae apostolicae Vaticanae phototypice editus. Praefatus est Guntherus Jachmann. Lipsiae, 1929.

29 Perhaps Vat. lat. 3199, Urb. lat. 365, or Pal. lat. 1729.

30 See *Il codice vaticano lat. 3196 autografo del Petrarca*, Roma, 1941.

31 *Bibliotheca seu bibliothecae Josephi Garampi catalogus*, Roma, 1796; see *Catalogo, 1828*, p. 36. For information on Garampi see Augusto Campana in *Studi su Aurelio Bertola nel II centenario della nascita*, Bologna, 1953, p. 47, n. 1.

32 He died seven years after Cotugno's visit, at the age of 56, and was buried at Santa Susanna; see Forcella, *op. cit.*, 1877, 9, p. 542, no. 1063.

33 Messedaglia, *op. cit.*, pp. 1715-1716, n. 3; pp. 1755-1756.

the Quirinal. The Barberiniana contained then, according to Ballerini and Cotugno (f.14), 60,000 printed books and 9,000 manuscripts. Some incunabula, like the Lactantius published at Subiaco,[34] Ballerini found good substitutes for the manuscripts; perhaps he wished to spare the manuscripts from too frequent use, or at least to acquire in editions of the fifteenth century texts which the library did not possess in manuscript. He showed Cotugno the first edition of Ariosto's *Orlando furioso*;[35] the copy, one of five on parchment, is probably the one which was given by the author to Cardinal Ippolito d'Este and which today still has at the Vaticana, because of its value and the beauty of its decoration, a place among the manuscripts.[36] Cotugno also saw one of the three copies at the Barberiniana[37] of the Aldine edition of the decrees of the Council of Trent.[38] This had, he tells us, at page CCXXXVIII the printed names of the three witnesses, whereas in the copy at the Vaticana[39] the original signatures were added in manuscript on the verso of page CCXXXIX. From 1902, in any case, all four copies have been reunited at the Vaticana together with the handsome shelving which was transferred from the Barberiniana.

But let us merge, if we may, Saliceti, Ballerini, Assemani, and the other librarians of Rome in order to disclose the special passion which ruled Cotugno in his visits to Roman libraries. He was interested of course in all fine editions, and in librarianship in general. But if we remember that he was making an *Iter Italicum Patavinum*, and therefore an *Iter Morgagnianum*, and that Giambattista Morgagni had been engaged at least from 1720 with Aulus Cornelius Celsus,[40] the conclusion is obvious that a young anatomist and bibliophile, fervid admirer of "Sua Maestà Anatomica," would take a special interest in manuscripts of the ancient Roman author. Celsus was, in fact, in particular fashion at this time. Almost unknown throughout the Middle Ages, he had returned to

34 Lactantius, Lucius Coelius Firmianus, *De divinis institutionibus adversus gentes libri VII. De ira Dei liber unus una cum libro de opificio hominis.* Subiaco: [Conradus Sweynheym and Arnoldus Pannartz] 29 October 1465. Now Biblioteca Vaticana, Stamp. Barb. AAA.II.9.

35 Ferrara, Francesco Rosso da Valenza, 1532.

36 Barb. lat. 3942; see the manuscript *Inventario*, no. 354.

37 Now Biblioteca Vaticana, Stamp. Barb. CCC.IV.26, V.24, 30; see the manuscript *Catalogo*.

38 *Canones et decreta sacrosancti oecumenici et generalis Concilii Tridentini . . . ,* Romae, apud Paulum Manutium Aldi filium, 1564.

39 Ott. lat. 2333; see the manuscript *Inventario*, no. 338.

40 His first letter on Celsus to Giambattista Volpi carries the date "Postrid. Idus Decembr. MDCCXX"; see *Epistolae duae altera in Aur. Corn. Celsum, altera in Q. Ser. Samonicum*, Patavii, Excudebat Josephus Cominus, 1721, p. xxxviii.

the light three and a half centuries earlier amid the enthusiasm of the humanists, and for the year 1426 there exists impassioned correspondence on the discovery of manuscripts of Celsus in letters of Guarino Veronese, Panormita, and Lamola.[41] In Cotugno's century it was, on the contrary, the physicians who were discovering Celsus—first Morgagni and Antonio Cocchi;[42] then Leonardo Targa of Verona, Morgagni's pupil, whose first edition of the eight books on medicine appeared in Padua in 1769; and Venanzio Lupacchini of Aquila in the Abruzzi, who died tragically by hydrophobia before he was able to finish his edition;[43] and Lodovico Bianconi of Bologna, whose twelve *Lettere sopra A. Cornelio Celso,* addressed to Girolamo Tiraboschi, librarian of the Estense, and provided with a dedication from the publisher to Natale Saliceti, were published anonymously at Rome in 1779. Cotugno therefore, influenced by the enthusiasm of his age for Celsus, requested medical manuscripts at the Alessandrina (f.9v) and found none. He requested a manuscript of Celsus at the Casanatense (f.11v); it had none then, as it has none today, but he examined instead a manuscript of Tommaso Cornelio.[44] He requested a manuscript of Celsus at the Barberiniana (f.14v); it had none, but Ballerini could console him with two items, first a copy of the Aldine edition in the margins and between the lines of which were variants of Marc-Antoine Muret in manuscript,[45] and then

41 Sabbadini, Remigio, in *Studi italiani di filologia classica,* 1899, 7, 120, 123-124, 127, 133-134. For Politian's interest in Celsus see Juliana Cotton Hill in *Durham University Journal,* 1954, *46,* Appendix I.

42 See his *Graecorum chirurgici libri,* Florentiae, 1754, pp. 52, 160-170. Saliceti was one of the "fautores" of this work who "pretio ante persoluto . . . adiutarunt"; see p. 173.

43 See pp. 262-264 in the work of Bianconi cited below.

44 *Meditationes de mundi structura,* now D.IV.38 (827) of the Casanatense and cited by Max H. Fisch in *Science, medicine, and history. Essays . . . in honour of Charles Singer,* collected and edited by E. Ashworth Underwood, London, Oxford University Press, 1953, *1,* pp. 523, 556. Cotugno adds, as the manuscript *Catalogo* also states, that the three last chapters are missing.

45 The Biblioteca Vaticana has, as Stamp. Barb. CCC.III.31, a copy of *Aurelii Cornelii Celsi medicinae libri VIII . . . Quinti Sereni liber de medicina . . . ,* Venetiis, in aedibus Aldi et Andreae Asulani soceri, 1528, with manuscript variants attributed to codices cited as "Cod. vet.," "cod. Manutii," "vet. cod.L." The friendship between Paulus Manutius and Muret is well known, but in the opinion of the Rev. D. José Ruysschaert, Scriptor of the Biblioteca Vaticana, the writing in the notes is not that of Muret. From the title page of the volume, indeed, although it has the inscription of the Collegio Romano, the words "E bibl. Mureti," usually present in books of Muret which passed from the Collegio Romano to the Biblioteca Nazionale of Rome, are missing. See Pierre de Nolhac, La bibliothèque d'un humaniste au XVIe siècle, in *Mélanges d'archéologie et d'histoire de l'Ecole française de Rome,* 1883, *3,* 202-238, and for annotations of Muret the copy in the Biblioteca Nazionale of Rome, 71.3.C.20, of Cicero's *Philippicae . . . a M. Antonio Mureto ad optimum et vetustissimum exemplar tam multis locis emendatae, ut nunc primum editae videri queant,* Parisiis, ex officina Gabrielis Buon, 1562. It is very probable, on the other hand, that the notes in the Celsus once at the Barberiniana and now at the Vaticana were copied from notes of Muret.

with information on the state of Lupacchini's and Bianconi's researches on Celsus.

Cotugno requested finally at the Vaticana a manuscript of Celsus (ff. 75v-76r), and Assemani handed him the now celebrated Vaticanus latinus 5951. Cotugno gives a description which is sufficiently accurate for a person who was not a trained palaeographer, mentioning for example the acquisition note of 1623 and the marginalia on f.65r which disclose on the one hand a loss of text and on the other the fact that a passage which follows in smaller characters is not from Celsus. Cotugno concluded, and we know today how grievously he erred, that the manuscript was of little value, and he returned to his lodgings. But by his few moments with Vaticanus latinus 5951 three facts are established for students of Celsus and for lovers of the Vaticana. In the first place, he made his visit in the spring, and probably at the beginning of the month of June, in the year 1765;[46] his description, therefore, although brief, precedes by ten years that of Bianconi, which dates from the autumn of 1775, was published in 1779,[47] and is stated in the modern definitive edition to have been the first.[48] In the second place, Assemani freely handed out this manuscript of the ninth century when Cotugno asked for a manuscript of Celsus; Bianconi therefore, whose letters on Celsus are a delight to read and furnish a mine of information, exaggerates when he says of this manuscript,[49]

Please forgive me if I have described to you in too great detail this literary relic. In addition to its great age, it has been until now practically hidden away, and I do not know why its keepers did not in times past show it to scholars who went there in search of manuscripts of Celsus, and handed out instead, I was about to say inhumanely, other manuscripts for collation which are late in date, insignificant, and of very little value. I should

46 Cotugno terminated his trip shortly after this and was at Naples on 12 June (f.77v).

47 Bianconi, *op. cit.*, pp. 204-211.

48 *A. Cornelii Celsi quae supersunt recensuit Fridericus Marx*, Lipsiae, 1915 (*Corpus medicorum latinorum*, I), p. xxxi. Bianconi had been collating manuscripts of Celsus at least since 1749; see his *Lettere*, p. 235. Lupacchini worked on this manuscript for many years, and his notes passed for the greater part, according to Salvatore De Renzi, *Auli Cornelii Celsi De medicina libri octo*, Napoli, 1852, 2, p. 3, to the Biblioteca Reale Borbonica, but I did not succeed in finding them in the present Nazionale in Naples.

49 *Op. cit.*, p. 211: "Scusatemi di grazia se forse troppo minutamente io vi ho descritta questa letteraria reliquia. Oltre alla sua grande vetustà, essa è stata quasi nascosta sinora, ne so per qual ragione que' custodi non l'anno ne' tempi andati mostrata ai letterati, che colà andavano a ricercare i codici Celsiani, anzi davano, starei per dire inumanamente, a collazionare altri Celsi recenti, insignificanti, e di pochissimo conto. Voglio però, che per loro onore, ne diamo la colpa agli Indici immensi, e tuttavia incompleti di quel tesoro, e in conseguenza, chi sa se i Bibliotecari neppure sapevano d'averlo."

prefer, however, out of respect for the keepers, to blame instead the huge and at the same time incomplete indexes of that treasure-house; perhaps the librarians themselves did not even know that they had that manuscript.

In the third place, in the manuscript *Inventario* of the Vaticani latini a marginal note for the entry 5951 states that the manuscript was missing when Stefano Evodio Assemani began his prefecture;[50] the manuscript, therefore, missing on 4 February 1768 and later found, was easily available at least in the spring of 1765. Perhaps the very fact that it was not available for a period of time after Cotugno saw it is the reason for Bianconi's accusations against the Vaticana. It is a pleasure to add that Cotugno's interest in Celsus continued all his life; on his death in 1822 his library contained[51] one manuscript of Celsus,[52] 24 editions printed from 1478 to 1810,[53] and Bianconi's *Lettere*. Cotugno wrote some *Adnotationes in Celsum* which unfortunately are missing today.[54]

Cotugno relates other incidents of interest to both medicine and bibliophily from his visits to the libraries of Rome. Fonda told him (f.74r) of the medical work, *Margarita antoniana*,[55] held by the library of the Collegio Romano. It survived, added Fonda, in only a few copies for the reason that Descartes, plagiarizing from it 80 years after its publication the principle *bruta automata*, tried to conceal his theft by buying and burning as many copies as possible.[56] Fonda also related (f.74v) that both before and after the accusation of heresy by the Council of Trent, the name of Robert Estienne was canceled in almost all the copies of his fine editions. His son Henri suffered in a similar manner, and the Roman bookseller (f.76v) who undertook to procure for Cotugno his renowned *Thesaurus graecae linguae*[57] could not promise to find a copy without any cancellations in the preface and in the

50 See Eugène Tisserant, Notes pour servir à la biographie d'Étienne Évode Assémani, *Oriens Christianus, 3d ser.*, 1932, 7, 264-276, and in particular p. 273.

51 *Catalogo, 1828*, pp. 63-64.

52 Now MS. V.A.10bis, saec.XV, in the Biblioteca Nazionale of Naples; see Modestino Del Gaizo in *Atti della R. Accademia Medico-Chirurgica di Napoli*, 1912, 66, 243, 245 and Tammaro De Marinis, *La biblioteca napoletana dei re d'Aragona*, Milano, 1947, 2, p. 44.

53 Of these, three were purchased on this trip; see the list of books which occurs at the end of the *Iter Italicum*, f.78.

54 Scotti, *op. cit.* in note 1, p. 54.

55 Gómez Pereira, *Antoniana margarita, opus nempe physicis medicis ac theologis non minus utile quam necessarium . . .*, Methymnae Campi, 1554.

56 At Padua (f.54r and Messedaglia, *op. cit.*, p. 1776) Giovanni Marsili made a similar accusation, that Descartes took certain principles from the work of Marcantonio de Dominis entitled *De radiis visus et lucis in vitris perspectivis et iride*, Venetiis, apud T. Baglionum, 1611, and that he then suppressed as many copies as possible. Cotugno bought on this trip an edition of the works of Descartes, possibly the one published at Amsterdam in 1698; see f.78v and *Catalogo, 1828*, p. 84.

57 Paris, 1572.

explanation of the word *Eucharistia*.[58] From the same bookseller Cotugno received advice on how to protect his books from insects.

Cotugno visited also, though briefly, the library of Sant'Onofrio (f.14r), the Angelica (f.14r), the library of the Palazzo Colonna (f.19v), and several others which he does not name (f.12r). He returned to Naples by way of Montecassino (f.77r), where the monks complained that many of their manuscripts had wandered, especially in the direction of the Vaticana. Throughout his life and through all his medical commitments he preserved the passion for books and libraries which had been his from youth. He revisited Rome, and therefore also its libraries. He was a friend of Francesco Saverio Gualtieri,[59] Royal Librarian at Naples, and of Gaetano Marini of Santarcangelo di Romagna, whose *Archiatri pontificj*, dedicated to Natale Saliceti, appeared in 1784.[60] In the spring of 1790 he sent advice on the health of Marini,[61] and Marini, who as prefect of the Archivio Vaticano lived in the world of books, performed book commissions for him, including at least one which concerned the library of Saliceti.[62]

[58] F.76v. Cotugno had already seen at Pesaro (f.26r and Messedaglia, *op. cit.*, pp. 1707-1710) in the library of the Marchese Giovanni Paolucci another book which was under suspicion, Cesare Beccaria's celebrated *Dei delitti e delle pene*, which had been published anonymously at Livorno in the preceding year and in 1765 was already in its third edition. Cotugno, according to Scotti, *op. cit.*, p. 31, n. 1, always observed carefully the rules for books on the Index, and on this very visit to Rome he "impetrò dalla Santa Sede la licenza di leggere, e di ritenere i libri proibiti. E pure non volle mai servirsene senza un preciso bisogno; e molti ancora ne diede alle fiamme, seguendo l'esempio degli antichi Fedeli. Anzi tornando a Roma sull' anno 1788, ammesso dal Sommo Pontefice Pio VI. ad una lunga udienza, ne ottenne il permesso di consultare il *Dizionario Istorico-Critico* del Bayle, ch'era stato escluso dal primo Indulto, e che poi mi promise di mandare insieme con altri perniciosi libri alla Reale Biblioteca Borbonica, temendo che dopo la sua morte avessero a capitare in mani non sicure." On the trip of 1765 Cotugno purchased Beccaria's book (f.78r), but it does not appear in the *Catalogo, 1828*.

[59] For information on Gualtieri see Aulisio Pierio, *Laudazione accademica in morte di Monsignor D. Francesco Saverio Gualtieri* (Estratta dalle Orazioni del Ch. D. Vincenzo Daniele, Canonico della Chiesa Metropolitana di Chieti, e Rettore del Real Collegio di detta Città, [1831?]), 31 pp. He was born in 1740 and died in 1831; from 1792 he was bishop of Aquila and from 1818 of Caserta. In a letter from Naples dated 26 December 1786 (Vat. lat. 9051, f.213r) he informs Gaetano Marini that he has been appointed Royal Librarian. Another letter of his from this manuscript has been cited in note 14. Numerous letters of his to Marini, dated from 1780 to 1803, first from Naples and then from Aquila, occur on ff.168-291; see Enrico Carusi in *Studi e testi*, 1940, *83*, 110.

[60] There was naturally a copy in Cotugno's library. See *Catalogo, 1828*, p. 168. Marini five years before had given his approval to Bianconi's *Lettere sopra A. Cornelio Celso;* see the *Lettere*, p. vii.

[61] In two letters to Gualtieri (Vat. lat. 9046, f.332r and 333r), 23 March 1790 and Good Friday, 1790, and in one to Marini himself (f.335), 7 April 1790. On 27 September of the same year in a letter from Naples (Naples, Biblioteca Nazionale, MS. San Martino 396, ff. 318-319) to Cotugno in Vienna Gualtieri speaks of "nostro buon Marini, che spera di rivedervi a Roma" and asks Cotugno's aid in acquiring some bibliographical works.

[62] Vat. lat. 9046, f.335r, Cotugno to Marini, Naples, 7 April 1790: "È pure finita quella eterna noja ch'io debbo avervi recata con commissioni, e più commissioni librarie, ma non è finita ne finirà mai l'ingenua mia riconoscenza . . ." F.335v: ". . . Ed oltre di questa grazia fatemene un' altra ancora. Quando vedrete Corona, il mio caro Corona, . . . mone, che non sia sì parco de' suoi caratteri, e che se quel libraio della Salicetiana si

Saliceti had died the preceding year. He may be regarded as strongest among the ties which bound Cotugno to the libraries of Rome, ties which pulled again when Juan Andres became in 1816 prefect of the Royal Library G. Murat of Naples. The tie between the libraries of Rome and the present Nazionale of Naples can be the *Iter Italicum* itself, which is rightly preserved with many other books of Cotugno's in the library for which he worked so earnestly[63] and whose prefect in 1823, Angelo Antonio Scotti, wrote from friendship and gratitude the *Elogio storico del cavalier D. Domenico Cotugno.*

trovasse d'avere ancora il n.° 442 che ha l'edizione di Londra delle Opere d'Harveii me lo consegni, e lo dia involto in carta al Sig. D. Giacinto Orsini, che gli recederà i tre scudi e mezzo, che vi avrà speso." See *Catalogo della biblioteca . . . di Monsignore Natale Saliceti* . . . , Pt. I, p. 49: "442 Harveii (Guilielmi) Opera omnia a Collegio Medicorum Londinensi edita. Londini. 1766. 4. l. f. [legatura francese] 3 50. *Magnifica, e superba edizione"* [Keynes 47]. But it is probable that the copy had already been sold, since it does not appear in the *Catalogo, 1828*. Corona was the physician Camillo Corona, later minister of the Republican government (Moroni, *op. cit.*, 1852, *59*, p. 47). Orsini Monsignor Giacinto Orsini of Gravina, vice-legate to Cardinal Ippolito Antonio Vincenti Mareri on the Bologna mission, 1795 (Moroni, *op. cit.*, 1860, *101*, p. 14). In several letters written to Cotugno from Rome in the spring of 1790 and later Corona speaks of the health of Don Giacinto; see in the Biblioteca Nazionale of Naples MS. San Martino 396, ff. 271, 275, 289, 420.

63 Scotti, *op. cit.*, p. 49: "Nè qui narrerò, come contribuì al pubblico bene coi Bibliografici suoi lumi, e col suo zelo; quando nell' anno 1802 fu membro di quella Giunta, cui l'ottimo nostro Sovrano commise l'apertura, la direzione, ed il perfezionamento della Reale Biblioteca destinata al pubblico vantaggio."

A Manuscript Translation of Gregory's *Conspectus Medicinae Theoreticae*

LLOYD G. STEVENSON*

JAMES Gregory (1753-1821) was Professor of the Institutes of Medicine at Edinburgh from 1773 to 1790, when he succeeded Cullen in the Chair of the Practice of Physic. What most people remember about him, in addition to his Mixture, is that he thrashed Professor Hamilton with a walking stick, was made to pay £100 in damages and said, as he put down the money, that he would willingly pay double for another chance. In his calmer moments he wrote some philological treatises (he was a famous Latinist), a mass of polemical tracts, in which is displayed what now appears a rather elephantine humour but which are said to have delighted his fellow citizens in Edinburgh early in the last century, and a once famous textbook, entitled *Conspectus Medicinae Theoreticae*.[1]

Gregory's *Censorian Letter to the President and Fellows of the Royal College of Physicians in Edinburgh*, published in 1805, extended to 142 pages, but he was already beginning to run down 40 pages earlier. On page 102 he had written: "Thus I have endeavoured, to the best of my abilities, to discharge some part of my Censorian duty to my brethren. When, in their utmost need, they so wisely put the rod into my hands, it would have been a sin not to apply it vigorously to the place appointed by Nature. . . ." Nothing could have been more characteristic of the First Physician to His Majesty in Scotland. It is appropriate, however, to remember that he lived at a time when Johnsonian ill manners were admired, and when rough, in fact blasphemous, language was not unknown among professional men in Scotland. The growlings of some of the great bears of the Scottish bench are more than adequately recorded.

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1 The Osler Library copy is dated 1780. The editors of the *Bibliotheca Osleriana* wrote of it: "Apparently the first ed. (though Haeser mentions 1776 and 1778, both very unlikely dates). Miss M. P. FitzGerald, who found this copy in Edinburgh in 1925 after a search begun in 1917 at Sir W. Osler's request, suggests that this ed. was not completed, Pt. 2 being first printed in the enlarged 2nd ed. of Pt. 1, in 2 vols., 1782, with sub-title (Pars altera, in qua de Therapeia agitur) after p. 110 of vol. 2. See the preface to that ed. The early eds. seem scarce; this of 1780 is in the B.M. catal. as '1780 (-2). Pt. 2 wanting', but is not in any of the Edinburgh libraries or the S.G.L. catalogue."

Professor Gregory was a medical hero, old style, sprung from the loins of heroes (he was the fifth of his name and line to hold an Edinburgh chair) and nurtured in a school of heroes; he was armour-clad in learning, probity, and common sense; he wielded the sword of wit; he rejoiced more freely than most in the public exhibition of his superb bad temper; and he was greatly loved as well as greatly feared.

"Dr. Gregory is a good man," wrote Robert Burns, "but he crucifies me." The poet also declared: "I believe in the iron justice of Dr. Gregory; but like the devils I believe and tremble."

If one can suppose that the *Epigrams and Poems,* printed in Edinburgh in 1810 by John Moir, of Royal Bank Close, are truly the work of "the celebrated Dr. Gregory," he himself thought iron no inappropriate image for poetic self-portraiture. "The Viper and File: Addressed to a Fellow Professor" concludes with a "gentle admonition" to the Viper:

> Welcome, base reptile, to assuage,
> On my strong hide, thy harmless rage;
> Till sad experience let thee know
> Thy blood, not mine, thou mak'st to flow:
> No gall of asps my bosom stains,
> No poison rankles in my veins;
> But countless teeth my skin environ,
> And every day I feast on iron.

Professor Gregory was in the habit of holding forth to his students while wearing, rather than a mortar board, a cocked hat; but Christison had more than this in mind when he pronounced him the most captivating lecturer he ever heard. It is said that Gregory's presence was commanding, his countenance noble, his voice resonant, his memory faultless, his mastery of language brilliant, his humour delightful and pervasive. Such was the torrent of fact and fancy that poured from his lips, he never had time for more than two-thirds of his subject.

No doubt a large part of his charm, for the masses of eager students who crowded his lecture theatre, was his flawless confidence. Another part, surely, was his superabundant energy. From both of these sprang a positive and active approach to the problems of disease. No expectant treatment, certainly, would suffice for him. The captains of the ranks of death found in the Professor a stout and fearless opponent, ready to bleed his patients smartly; he was ready, too, with blisters and clysters and with a choice list of

vigorous drugs. His famous Mixture was one of his milder concoctions.

On the other hand, he did not lack that broad scepticism which appeals so strongly to the young. "He neither is nor ever was, nor ever will be," he wrote of himself, "either an Empiric or a Dogmatist. He would have been a keen Dogmatist, but that he found at least ninety-nine in the hundred of medical Dogmas were false, and many of them stark nonsense. He would have been a determined Empiric, but that he found at least ninety-nine in the hundred of Empirical facts were as false, and more than that proportion of their remedies as insignificant, and as dangerous, as any of the Dogmas of their opponents. Of course he now lives a sad outcast from both parties, just like a man excommunicated as an Atheist by a congregation of Fanatics and expelled as a Fanatic by a Royal Academy of Atheists."[2]

He seems to have lived in a world of unvaried blacks and whites. Professor Hamilton, Dr. John Bell, the rotating surgeons of the Royal Infirmary, like ague, phthisis, and gout, roused him to arms at a word. It cannot be said that he made short work of his enemies—with the exception, perhaps, of poor Hamilton—for he pounded them with massive quartos, fired off squibs at their heads and clubbed away tirelessly with sarcasms more remarkable for weight than for edge, year after year; while to disease he opposed himself with the same tenacity of purpose and with a full armamentarium of potent remedies. In rhetoric and ipecac, jeers and jalap, banter and the bark, he found weapons ready to his hand and he used them with a will.

He had yet another weapon, more deadly than any of the rest. In his battles with the surgeons, indeed in all of his controversies, large and small, he was right in the main and almost never demonstrably wrong. This was of course insufferable and probably accounts for most of the acrimony of his foes. If he had been half as fortunate, which was too much to hope for, in his therapeutic doctrines as he was in his views about medical organization and the conduct of hospitals, he would rank among medicine's immortal names.

This extraordinary man had another side to his nature. Despite his fiery temper he was fundamentally kind. He was kind,

2 *Memorial to the Managers of the Royal Infirmary,* Edinburgh, 1800, pp. 221-222.

at any rate, north by east and in surprising ways. Agnes Grainger Stewart illustrates this with a story:

> One day when he was giving out tickets for his class, he had to go into another room to fetch something. When he came back he saw a student, who was waiting for his ticket, take some money off his table and put it into his pocket. The Professor gave him his pass and said nothing, but just as the lad was leaving the room, he rose up and laying his hand on his shoulder said, "I saw what you did and I am so sorry. I know how great must have been your need before you would take money. Keep it, keep it," he added, seeing that the student meant to give the stolen money back to him, "but for God's sake never do it again."

Where in this are we to look for "the iron justice of Dr. Gregory?"

The Osler Library has recently acquired—from Mr. Heinemann in Mansfield Street, Montreal—two large, badly shaken quarto volumes containing a complete translation, in manuscript, of Gregory's *Conspectus*. With them is an A.L.S. from Gregory addressed to A. J. Christie of Tain:

> Edin^{r}: 26 March
> *1813*
>
> Sir/
>
> You have done me a great deal of honour in taking the trouble to translate my *"Conspectus"* into English: but you may be sure, from my having written it in Latin, and never having put it into English, that I *did not*, and at this hour *do not*, wish it to appear in English.
>
> Everybody is perfectly entitled to translate it into any Language that he pleases. But I must beg that it may be clearly understood that I have no concern in any such Translation.
>
> I think it but fair also to warn you that I am confident the publishing such a Translation *never can afford you any Profit*: but probably just the reverse; at least if you print and publish it at your own Expence & risk. A small Edition (for example 500 Copies) even if it should all be sold in two or three years (which is very improbable) could afford no profit after paying Paper, Printing, Advertising; & *Bookseller's Profit* (33 per cent on the Shop price) without which it would never sell at All. A *large* Edition (1000 or 1500) which *if all sold* might leave you some profit would *not be sold in many years : perhaps never*: and the first Expence of it would be ruinous to you. No Bookseller in his Senses would give you anything considerable for your Copy (as they call it—your Copyright in your Translation.) Nay I doubt much whether any Bookseller would take the risk of the Publication even if you gave him your Translation for Nothing.
>
> Farewell
> J GREGORY

In all this curt and thumping letter, no word is said of the rights of the author. "I have no concern in any such Translation."

Gregory could not prevent the translation of his Latin writings. I have not seen *A Dissertation on the Influence of a Change of Climate in Curing Diseases,* translated by W. P. C. Barton and published in Philadelphia in 1815 as an octavo of 212 pages, which is listed in the third series of the *Surgeon-General's Catalogue,* but it would hardly be surprising if it had appeared without Gregory's approval. The *Conspectus,* too, was translated more than once and made its appearance in several languages. Robert Venables even produced in 1836 a literal interlinear translation of the first twenty-three chapters, with rules for translating "illustrated by examples from the more difficult passages of Gregory and Celsus," which suggests that Gregory's reputation as a Latinist matched, and possibly outlasted, his reputation as a physician.

Who the unfortunate Christie may have been I have not ascertained. The dominie of Tain, perhaps, or an eccentric country gentleman of small means; not, I think, the minister or the doctor. Whoever he was, it is easy to imagine him toiling steadfastly at his translation of the *Conspectus,* night after night, by the glimmer of a candle, faithfully mending his phrases and adjusting their cadence to make them worthy of the elegance of his Latin author, copying out his work page by page in a firm, clear hand until it filled two handsome quarto tomes, wrapping them proudly for transmission to the great Dr. Gregory, no doubt with a carefully worded and very respectful, hopeful letter, and then unsealing, with a mixture of trepidation and delight, that august man's reply. To imagine his sentiments as he read that reply is an exercise both painful and pathetic, but also—the letter was written a century and a half ago and the wretched Christie will not mind—also a little bit funny. The response is so outrageous, so characteristic, written in so fine a Gregorian huff, our sympathy for the translator is not altogether as acute as we feel it should be. He was put down, poor chap, with a roll of thunder that did him proud!

Is there not something else here besides, something we might not detect were we not aware of the singular character of the author of the *Conspectus?* A rough kindness (life the caress of a file) is clearly intended to be conveyed, and what our knowledge helps us to appreciate is not so much its presence as its truth, Gregory really meant to be kind as well as firm and no doubt his advice was good. It is to be hoped that his devoted translator was able, at least on second or third reading, to find some hint of this himself. It is also to be hoped, none the less, that his principles per-

mitted him to receive these kindly and rather barbarous admonitions with suitable profanity.

Finally, one hopes that the tempest in Tain was succeeded by lasting tranquillity; and that when Christie came at length to his deathbed no well-meaning surgeon or apothecary prescribed for his comfort a bottle of medicine to rest on his bedside table and mock his dimming vision with unholy words on the label: Gregory's Mixture.

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STEWART, AGNES GRAINGER. *The academic Gregories*. Edinburgh, 1901.

"THE ANATOMICAL THEATRE, LEIDEN, AS A KUNST- UND WUNDERKAMMER" 1610

Engraving by Willem van Swanenburgh (1581-1612) after J. C. Woudanus (van't Woudt) (1570-1615). New Haven, Yale Medical Library, Clements C. Fry Collection.

At a designated time during cold December or January, a body was "anatomized" at Leiden. So wrote J. J. Orlers in 1614, describing the anatomical theatre of that city.* The dissection was carried out before "the rector magnificus, the assessors, the professors, doctors, surgeons, and students of Medicine, as well as many persons of every rank of society who are desirous of knowledge of the human frame and instruction regarding it."

The Anatomical Theatre at Leiden, constructed in 1592 after the manner of the ancient Roman theatre, was divided into six galleries from which the guests might view the dissection. The professors and "certain other people of rank and dignity" were seated around the dissecting table. Behind them stood the surgeons and students of medicine.

In the circle is a rotating table draped in black on which the body, partially covered by a white linen sheet, is placed. Around the galleries are skeletons "of persons male and female who have been put together with utmost skill by means of copper wires." Six of these skeletons hold banners bearing mottoes in Latin which deal with the transitory quality of man's body. In the center beneath a tree are the bones of a man and woman representing Adam and Eve and the fact that "through the lapse of our first parents, death has come." The crude anatomical instruments are placed in a case, top center. Many animal skeletons appear, recalling that dissections were often performed on animals rather than human cadavers. The men and women in conversation, one man apparently holding a whole human skin, generate a festive air about the theatre.

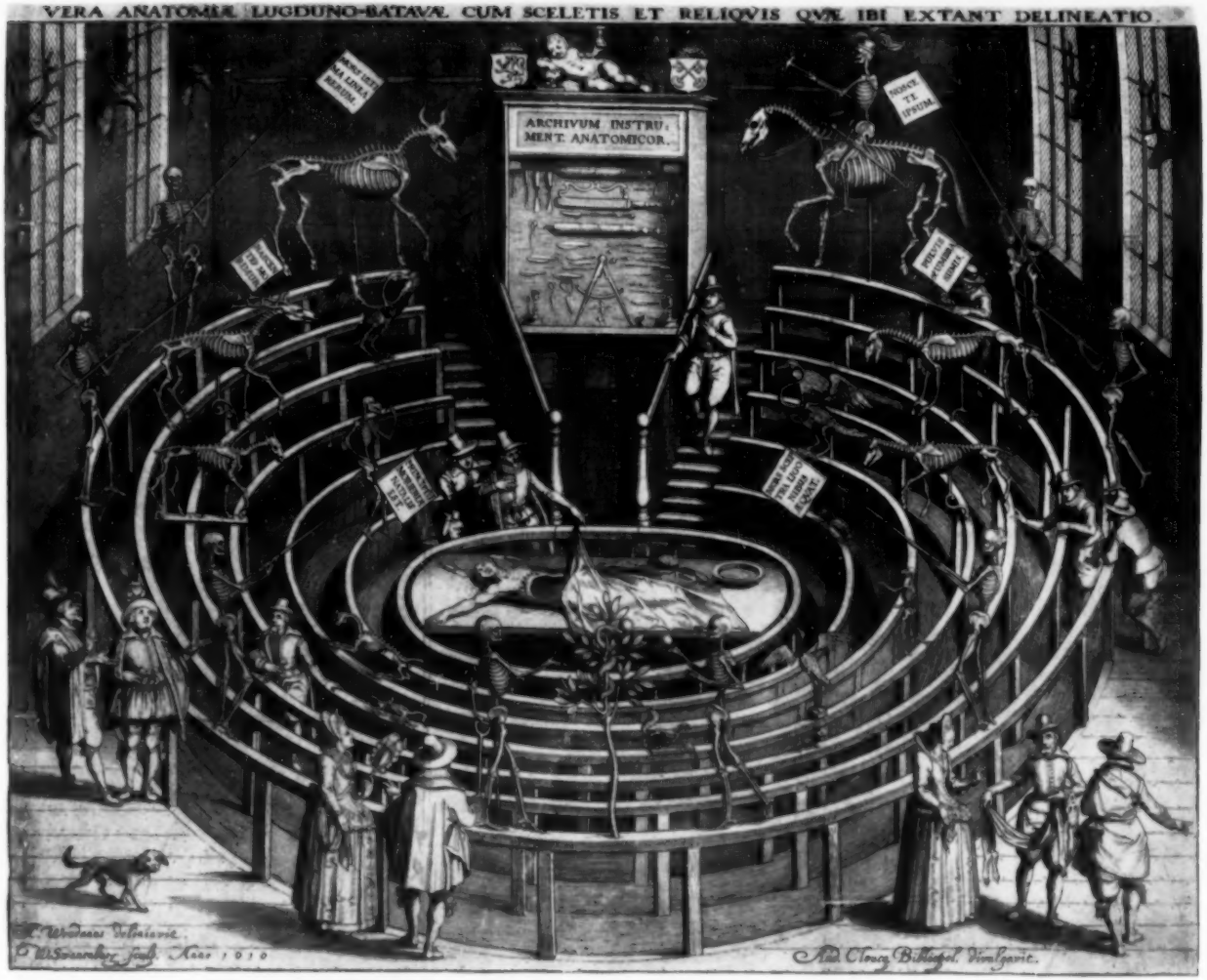
M. J. A.

* Orlers, J. J. (1570-1646), *Beschrijvinge der Stadt Leyden. . . .*, Leiden, 1641 (ed. princeps 1614) quoted in William S. Heckscher's *Rembrandt's Anatomy of Dr. Nicolaas Tulp*, New York, 1958.

First of a series of medical prints, chosen and described by members of the board of student editors and reproduced by collotype at the Meriden Gravure Company. Full-size copies of one of the prints to be reproduced this year can be made available at a reasonable cost if sufficient interest is shown. Readers' comments are invited on this new feature of the JOURNAL.

THE EDITORS

VERA ANATOMIÆ LUGDUNO-BATAVÆ CUM SCELETIS ET RELIQVIS QVÆ IBI EXTANT DELINEATIO.



Notes and Events

Edited by Dorothy M. Schullian*

J.F.F. and Robert Boyle

Several years ago Dr. John Fulton was persuaded to undertake a revision of his *Bibliography of the Honourable Robert Boyle* which had appeared originally in 1932 in the *Proceedings and Papers of the Oxford Bibliographical Society*, with *Addenda* published the following year. He worked on this in the late months of 1958 and the first half of 1959, taking the finished MS to England with him in August of that year. He had hoped that the book would appear during 1960 while the celebrations of the tercentenary of the Royal Society were in progress, since Boyle had been one of its founder members and influential in the early development of the Society. The Clarendon Press, however, was not able to put a 1960 date on the book although all the proofs had been read before Dr. Fulton died on 29 May 1960; it therefore carries 1961 in its imprint.

The Boyle Collection in the Historical Library at Yale is an extensive one, containing as it does not only Dr. Fulton's holdings but also those of Dr. Harvey Cushing and Dr. Arnold Klebs. It is therefore not too often that an edition appears on the market which is not already in the collection. Less than a month after Dr. Fulton's death Mr. Jacques Vellekoop (who now carries on the firm of E. P. Goldschmidt & Co., Ltd., of London) arrived in New Haven with a fine copy of the first Latin edition of the "Physiological Essays"—*Tentamina quaedam physiologica diversis temporibus & occasionibus conscripta* (Londini, Impensis H. Herringman, 1661)—III.27 in the Bibliography. Dr. Fulton had known of only four copies—at Oxford, Paris, Vienna, and in the private collection of Sir Geoffrey Keynes. It has seemed highly appropriate that this volume should be the first to carry the new bookplate of the John F. Fulton Book Fund which is being designed by his friend and university colleague, Professor Deane Keller. The Book Fund, which was inaugurated by a most generous donation from Mrs. Fulton, has been further increased by gifts from many of Dr. Fulton's friends, classmates, and colleagues. The Fund will be administered by a small committee, and the purchases will be made in any of the fields where his widely ranging interests had carried him in four decades of happy and fruitful bookcollecting.

In addition to his pleasure at having an important Boyle item added to his collection, Dr. Fulton would have been further intrigued and delighted at the bibliographical variations it contains. In his note (p. 23 in the 2d ed.) he mentions that the first and fourth sub-title pages are single leaves and

* History of Science Collections, Cornell University Library, Ithaca, New York.

were probably printed together as a half-sheet. In the volume just acquired these two leaves immediately follow the title-page and are indeed printed on the same half-sheet, as the slightly loose binding reveals. Turning the leaves, one finds that sig. F2 comes before F1 and F4 before F3 (pp. 33-40), indicating that this gathering had been folded incorrectly by the binder. And on G2 the compositor failed to repeat the catchword *ejusdem* from G1*b*—a further example of the innumerable errors that crept into Boyle's publications because of the haphazard way in which his manuscripts went through the press.

MADELINE E. STANTON

"Dr. Thudichum on the Contents of Perspiration as Discharging the Matter of Disease," 1860

Johann Ludwig Wilhelm Thudichum (1829-1901) is now recognized as an important figure in the history of medicine, particularly as "chemist of the brain," and it is a debt of honor to record any addendum to the canon "of some 215 items" which Professor David L. Drabkin collected in the annotated handlist of writings appended to his devoted and meticulous biography published in 1958. While tracing treatment by hot baths in lunatic asylums in the 19th century we came across a curious book entitled *Manual of the Turkish bath. Heat a mode of cure and a source of strength for men and animals. From the writings of Mr. Urquhart, edited by Sir John Fife* (London, Churchill, 1865, xiv, 419 pp.). Fife (1795-1871) was senior surgeon to the Newcastle Infirmary where he introduced in 1859 the Turkish bath which David Urquhart (1805-1877), diplomatist and Turcophile, had brought to the British Isles and publicized in his two-volume *Pillars of Hercules,* 1850, and by meetings and lectures all over the country.

The book opens with notes of a meeting held on 27 July 1860 attended by "between 30 and 40 Medical and Professional Gentlemen, and others" (pp. 1-48), where Urquhart confessed that his enthusiasm arose from the fact that the bath had four times saved his life; the other main speakers were Sir (William James) Erasmus Wilson (1809-1884) and a retired practitioner from Bradford, Mr. Witt. Those present included Sir William Topham, whose paper with W. Squire Ward on *A case of successful amputation of the thigh, during the mesmeric state* had aroused so much controversy in 1842; he asked one question: whether extreme perspiration was debilitating (p. 21).

In February 1861 Thudichum read a paper on this subject to the Medical Society of London (Drabkin no. 34), part of which is quoted on pp. 250-251. In the ensuing discussion Urquhart invited such members as remained incredulous and indeed "the whole Society" to take the bath at Riverside, his residence at Rickmansworth in Hertfordshire, and promised "after that . . . to answer any questons. . . . This invitation was accepted: an entire day was allotted for this purpose." He records that "the deputa-

tion, filling an omnibus, and accompanied by a short-hand writer, arrived soon after ten A.M., returning to the station only about ten P.M. . . . I was subjected to an examination of seven hours" (pp. 251-252). Part of these proceedings are reproduced on pp. 60-120, followed by a description of "The Bath at Riverside" taken from Erasmus Wilson's account of the visit published in *The Eastern or Turkish bath,* 1861.

Thudichum was present on this occasion and took a lively part. He enquired of Urquhart his views on the origin of the Roman bath (pp. 61, 64); quoted a letter in the *British Medical Journal* about the temperature of the bath in the East (p. 71); wondered what Urquhart thought of the Cossack custom of recuperating from a hard ride by lying in "the common baking stoves of the peasantry" (pp. 71-72); mentioned a patient of Spencer Wells who developed alopecia "after one or two baths" (pp. 76-77); praised the value of the bath in the treatment of obesity (p. 80); referred to Urquhart's treatment of "consumption by the means of the rays of the sun" (p. 92); asked whether the bath by "determining of the blood to the surface" proved injurious in patients suffering from "external irritation" (p. 106); remarked he had observed that it was possible not to feel cold although naked at room temperature but to feel cold as soon as clothes were donned (p. 110); asked Urquhart's "opinion on the part played by perspiration in the human economy" (p. 111) and "with respect to the contents of perspiration" (p. 113); and expounded "a point which no scientific man has hitherto observed," namely, "that you can remove as much [waste matter] from the skin in one hour in the bath as can be removed by any other organ in twenty-four hours" (p. 114). On p. 116 Urquhart mentioned a "discussion between Mr. Erasmus Wilson and Dr. Thudichum" on "the amount of the perspiratory vessels being equal in amount to two-thirds of the kidneys"; on p. 118 Thudichum criticized as "fallacious" experiments reported to the Medical Society that "heat changes the [blood] corpuscles," and on p. 119 he noted that excessive perspiration increases the specific gravity of the blood. In a footnote on p. 120, repeated on p. 243, is quoted an extract from Thudichum's defence of the Turkish bath in one of the medical journals. On pp. 287-292 are two letters to Urquhart from a patient of Thudichum who was treated with the bath, and on pp. 293-294 a letter from Thudichum himself describing his management of the case.

The title of the present communication is that of a letter from Thudichum to Urquhart dated 26 December 1860 and reproduced on pp. 280-282; it deals with the chemistry and physiology of sweat and may deserve a Drabkin number in a future edition since this subject is not mentioned in the titles of items in the bibliography. In addition, the book deserves notice as pioneering that now flourishing form of medical literature which presents advances, especially in treatment, by publishing the proceedings of an organized symposium.

Richard A. Hunter
Ida Macalpine

Paperbacks at the New York Academy of Medicine

The Library Publication Committee of the New York Academy of Medicine will venture into the paperback field when it adds six volumes to its History of Medicine Series in the early months of 1962. The Hafner Publishing Company which brought forth the handsome edition of Morgagni (no. 13 in our series) will produce at moderate prices ($2.75-$3.75) the contributions listed below. The Committee looks forward to making these classic texts available to the student, historian, and general reader.

Pinel, Philippe. A Treatise on Insanity, in which are contained the principles of a new and more practical nosology of maniacal disorders . . . Translated by D. D. Davis, M.D. . . . Sheffield, W. Todd, 1806. With an introduction by Paul F. Cranefield, Ph.D.

Rush, Benjamin. Medical Inquiries and Observations upon the Diseases of the Mind. Philadelphia, Kimber & Richardson, 1812. With an introduction by Dr. S. Bernard Wortis.

Corvisart, Jean Nicolas. An Essay on the Organic Diseases and Lesions of the Heart and Great Vessels. . . . Boston, Bradford & Read, 1812. With an introduction by Dr. Dickinson W. Richards.

Laennec, René Théophile Hyacinthe. A Treatise on the Diseases of the Chest. . . . London, Underwood, 1821. With an introduction by Dr. Paul Klemperer.

Heberden, William. Commentaries on the History and Cure of Diseases. London, T. Payne, 1802. With an introduction by Dr. Paul Klemperer.

Charcot, Jean Martin. Lectures on the Diseases of the Nervous System. Delivered at La Salpêtrière. 2.ser. London, New Sydenham Society, 1881. With an introduction by Dr. Walther Riese.

GERTRUDE L. ANNAN

Dr. Edwin S. Clarke Accepts Post at Yale

Edwin S. Clarke, M.D., M.R.C.P., has accepted the post of Visiting Associate Professor of the History of Medicine at the Yale University School of Medicine and will enter upon his duties on 1 February 1962. Dr. Clarke, who received M.D. degrees from the Universities of Chicago in 1946 and Durham, England, in 1954, had training in neurology in this country and held positions at the Radcliffe Infirmary, Oxford, the National Hospital, Queen Square, the Hammersmith Hospital, and the Postgraduate Medical School, London. He occupied the post of Assistant Scientific Secretary to The Wellcome Trust before he came to this country in December of 1959. He has done research at the Institute of the History of Medicine, Johns Hopkins, and the University of California at Los Angeles. During the past year and a half he has served as instructor and assistant professor of medical history at Johns Hopkins.

Historical Gleanings

The notes which precede this section would have had special appeal for Dr. Fulton. It is hoped that likewise here, in a section to which he used to contribute so many significant and delightful bits, something of his spirit may continue to shine in this and future issues. We all remember the importance which he attached to meetings of historians, to the spontaneous and fruitful interchange of knowledge which such occasions foster. He would have been pleased by the opportunities presented of late on both local and broader levels, and in particular by those which encourage the participation of students. A Medical History Group has flourished at the University of Missouri, for example, since 1958. Its monthly meetings draw faculty members, students, and laymen and provide speakers from the Medical Center itself, from other departments of the University, and from beyond the Columbia area; details of future meetings may be procured from William K. Beatty, Medical Librarian, M210 Medical Center, Columbia, Missouri.

The History of Medicine Society at the Washington University School of Medicine devoted its meeting of 2 November 1961 to the circulation of the blood; Dr. Estelle Brodman, Librarian and Associate Professor of Medical History, can furnish announcements of future programs.

On 16 August 1961 a Medical History Club was founded, on the initiative of Dr. Hymie Gordon, at the University of Cape Town in South Africa; only a month later it prepared in the Medical Library an exhibition, "The Development of the Textbooks of Pathology," to mark the 200th anniversary of the publication of Morgagni's *De sedibus et causis morborum*. Included were original editions, facsimiles, photographs, and specimens of morbid anatomy to illustrate the works of Benivieni, Bonet, Morgagni, Rokitansky, Virchow, Aschoff, Muir, and Dr. W. A. D. Anderson, the last of whom formally opened the exhibition on 22 September.

On 8 November 1961 Dr. Francis C. Grant, Emeritus Professor of Neurosurgery at the University of Pennsylvania, delivered the Third Victor Robinson Lecture in Medical History at the Temple University School of Medicine; his address, appropriately entitled "Victory over Pain" from Dr. Robinson's last book, reviewed the history of neurosurgical procedures for pain relief.

On the state level, The Ohio Academy of Medical History will convene in Cleveland on 28 April 1962; details will be available from the Secretary-Treasurer, Dr. Bruno Gebhard, 8911 Euclid Avenue, Cleveland 6, Ohio.

A first Congresso Nazionale di Storia della Terapia was held on 15-16 October 1961 in Rome.

Of absorbing interest to readers of the Journal will be, of course, the Thirty-Fifth Annual Meeting of the American Association for the History of Medicine, which will be held in Los Angeles, 3-5 May 1962, and the Xth International Congress of the History of Science, which will meet

at Cornell University, Ithaca, New York, 26-31 August 1962, and at The American Philosophical Society, Philadelphia, Pennsylvania, 31 August-2 September.

The Journal reported in 1959 (*14*, 392) that the library of Dr. Lawrence Reynolds, who like Dr. Fulton took satisfaction and joy in collecting early books in the history of medicine, had been presented to the University of Alabama. Dedicated on 2 February 1958 and installed in a building especially erected for it at the Medical Center, it contains about 5,000 items. Dr. Reynolds, who was born in Ozark, Alabama, on 11 February 1889 and was graduated A.B. from the University of Alabama in 1912 and M.D. from the Johns Hopkins University School of Medicine in 1916, died in Detroit on 17 August 1961. His career in roentgenology had been long and distinguished, and it was as Roentgenologist at the Peter Bent Brigham Hospital in Boston in 1919-1922 that he knew that other bibliophile, Dr. Harvey Cushing. Dr. Reynolds had been in private practice since 1922. He assisted on advisory committees of the Historical Library of the Yale University School of Medicine, the William L. Clements Library of the University of Michigan, and the Detroit Public Library. He was buried in the cemetery adjacent to a chapel which he had presented to the people of his native town.

We recorded here in 1959 (*14*, 392) the death of the physician Giuseppe Bastianelli at the age of 96. His brother, the surgeon Raffaele, joined him in death on 1 September 1961 at the age of 97. Both were renowned for their services over many decades to the relief of suffering and the progress of medicine. With them an era passes, and the many Americans who knew them in Rome join in the general mourning. Special sympathy goes to Mrs. Raffaele Bastianelli, American by birth, and to Dr. Cesare Frugoni, devoted pupil. Dr. Raffaele's extensive library will pass by his wish to the Surgical Clinic of the University of Rome.

In *The Library*, Fifth Series, 1961, *16*, 55-57 Richard J. Durling describes four editions of Galen and Hippocrates which were published in Paris in 1527. One is signed by the printer Simon Du Bois, and the other three, unsigned, are with good reason attributed to him.

J. F. Gilliam examines in the *American Journal of Philology*, 1961, *82*, 225-251 "The Plague under Marcus Aurelius," for which there is relatively little information in contemporary authors. Striking and sweeping statements about it are not found until the fourth and fifth centuries. He concludes that, with due allowance for distortion and rhetorical convention in later writers, the epidemic was quite clearly great and destructive, but that it cannot on the basis of present evidence be compared in severity and demographic effects to the Black Death of the 14th century.

Vern L. Bullough has contributed an article entitled "Duke Humphrey and his Medical Collections" to *Renaissance News*, 1961, *14*, 87-91.

We remember the modesty with which Dr. Fulton carried through the press in 1943 Harvey Cushing's *Bio-Bibliography of Vesalius* (New York, Schuman's). On page 82 of that work there occurs discussion of a sepia ink drawing in the Hunterian Library, University of Glasgow, which corresponds in reverse to the picture on the title page of the *Fabrica* but lacks the architectural background and the text. Authorities disagree on whether this drawing was a sketch for or is a copy from the title page. Robert Donaldson contributes one point to the controversy in *The Bibliotheck*, 1961, *3*, 96-97. A reprint of the *Bio-bibliography*, with Addenda and Corrigenda, is soon to be issued by Archon Books of Hamden, Connecticut.

The papers delivered by Charles Donald O'Malley and A. Rupert Hall at the Sixth Clark Library Seminar, 6 May 1961, have been published under the title *Scientific Literature in Sixteenth & Seventeenth Century England* (William Andrews Clark Memorial Library, University of California, Los Angeles, 1961, 47 pp.). The papers are entitled respectively "English Medical Literature in the Sixteenth Century" and "English Scientific Literature in the Seventeenth Century."

The quarterly for Dutch art history which is entitled *Oud-Holland* contains in an issue published in July 1961 (1960, *75*, 125-142) an article by P. J. Vinken on H. L. Spiegel's *Antrum Platonicum*. The engraving (1604) of the same title by Jan Saenredam indicates in a subscription that Spiegel was responsible for the idea of the representation, and a passage in Spiegel's *Hertspiegel* lends further support to the assumption. The engraving is dedicated to Spiegel's nephew, the physician Pieter Paaw, who would have provided him with anatomical facts. The cave represented in the engraving has the internal structure of the heart as it was depicted by anatomists of that era, and Spiegel's emblem constitutes a remarkable contribution to the symbolism of the heart.

Jessie Dobson and Bryn Thomas print in *The Bibliotheck*, 1960, *3*, 61-67 two letters to William Hunter from renowned American pupils, the first from John Morgan in London, 18 March 1761, and the second from William Shippen, Jr. in Philadelphia, 5 November 1765. They are preserved in the Hunterian Library, University of Glasgow. The first appears to concern the "Chased Silver Cup" which was presented to Hunter by his students of anatomy and is mentioned in his will.

Luigi Belloni continues to publish in *Physis* articles of interest to medical historians. Volume 3, for 1961, contained on pages 37-48 his study "Dalle *Riproduzioni animali* di L. Spallanzani agli *Innesti animali* di G. Baronio" and on pages 167-173 his "Echi del 'Discorso accademico' di P. Moscati sull'uomo quadrupede—la recensione di Kant."

The standing of the Yale Medical Library today is in large part due to the efforts which Dr. Fulton expended in its behalf. Kindred spirits in

earlier years were Elihu Yale, Thomas Clap, Jeremiah Dummer, Daniel Turner, and George Berkeley. Their contributions are discussed by Frederick G. Kilgour in his article "The First Century of Medical Books in the Yale College Library" (*The Yale University Library Gazette,* 1961, *35,* 101-105).

S. F. Cook's account of the expedition of Francisco Xavier Balmis, which started out in 1803 to carry vaccine to Spain's dominions (*Bull. Hist. Med.,* 1942, *11,* 543-560 and 1943, *12,* 70-101), is cited by Lewis U. Hanke in *The John Carter Brown Library Conference* (Providence, 1961), pages 36-37.

The Journal stated in 1958 (*13,* 95) that the Museum of Medical Progress in Prairie du Chien, Wisconsin, at the hospital where William Beaumont completed his basic studies in the physiology of digestion, would be open to the public in two years. It is a pleasure to report now that it completed its first full year of operation on 31 October 1961. It is a joint project of the Charitable, Educational and Scientific Foundation of the State Medical Society of Wisconsin and the State Historical Society of Wisconsin.

In a lengthy note in *The Times Literary Supplement* for 11 August 1961 Richard A. Hunter and Ida Macalpine set forth the hitherto little noticed relations between Dr. John Conolly and Charles Dickens, thereby linking science and literature in a manner which would have delighted Dr. Fulton. Two of the letters which document the relationship, Dickens to W. H. Wills on 14 April 1853 and on 23 November 1863, are preserved in the Henry E. Huntington Library.

For the centennial of the State of Kansas John B. Runnels and George F. Sheldon, of the class of 1961, University of Kansas School of Medicine, issued *A Pictorial History of Kansas Medicine,* in 16 spiral-bound, unnumbered leaves, which may be obtained for two dollars from the Student Union Book Store. It was reviewed by *The Kansas City Times* of 9 June 1961. Crammed with almost 200 photographs and explanatory text, it gives a vivid account of medicine and medical education in Kansas from 1861 to 1961. The cover carries the portrait, in a modernized version of Sir Luke Fildes's famous painting *The Doctor,* of a former editor of this section, Ralph H. Major.

In the Garrison-Morton tradition and with the text of Leslie T. Morton's Yale Woodward Lecture in 1960 on the history of that bibliography, Lee Ash of the Yale University Library published in 1961 under his own imprint, "The Antiquarium," the bibliography, *Serial Publications Containing Medical Classics.* The volume, arranged by title of publication, then chronologically, and then by volume and page numbers, indexes some 5,000 entries in over 900 serial publications issued from the sixteenth to the twentieth century. Gertrude L. Annan contributed the Foreword. Mr. Ash also issued in 1961, through the R. R. Bowker Company of New

York, the second edition of his *Subject Collections: A Guide to Special Book Collections and Subject Emphases as Reported by University, College, Public and Special Libraries in the United States and Canada.*

The Library of Congress becomes increasingly the depository for the collected papers of famous scientists. Those of the physiologist Dr. Jacques Loeb (1859-1924), who is best known for his experimental work in inducing parthenogenesis and regeneration by chemical stimuli and for his development of the tropism theory, were recently presented by his children; Dr. Selman A. Waksman, discoverer of antibiotic streptomycin, recently presented a selection from his own papers. When these items have been organized they will be available for research purposes in the Manuscript Division.

As Honorary Consultant and in other capacities Dr. Fulton rendered devoted service over many years to the National Library of Medicine. The privilege of being present at the dedication of its new building 14-15 December 1961 would have given him great delight. He would have rejoiced also in the record set down for that library in the special Anniversary Issue, 1836-1961, of the *Bulletin of the Medical Library Association,* July 1961, in which are commemorated one hundred and twenty-five years of the library's history. For this issue the Director, Dr. Frank B. Rogers, served as Guest Editor, and in it are published 12 articles bearing on the library's history and current activities.

Book Reviews

JOHN F. FULTON. *A Bibliography of the Honourable Robert Boyle, Fellow of the Royal Society.* 2d ed. Oxford, at the Clarendon Press, 1961. xxvi, 218 pp. port. front., 26 illus. 50s.

Reviewed by F. N. L. POYNTER, *Chief Librarian, Wellcome Historical Medical Library, London, England.*

FULTON'S *Bibliography of the Honourable Robert Boyle,* first published in the Oxford Bibliographical Society's *Proceedings* and later extended by an *Addenda* (1933) and *Second Addenda* (1941), has long been regarded as a model for the bibliography of an individual author. As one of the earliest 'bio-bibliographies' it enlarged the horizons of the average bibliographer by giving ample demonstration that his work could be enriched and illuminated by a keen study of the text and the circumstances which produced it. The introductory notes to the individual items already, in the first edition, revealed the depth and range of Fulton's reading; in this second edition they have been largely re-written so that—in total—they form an admirable guide not only to Boyle's writings but to his interests, his friends, and even his intimate thoughts. If one ever doubted whether comment of this nature fell within the province of the bibliographer, all such doubts are laid aside after reading this new and elegant edition. It is indeed a bibliography which can be read and not merely consulted.

Of the importance of the subject there can be no question, for Robert Boyle is one of the key figures of the scientific world of the seventeenth century, just as his time is one of the key periods in the history of modern science. The stimulus which the first edition gave to studies of Boyle is apparent from the great amount of work which has been done in the interval between the two editions, a veritable 'upsurge of interest,' as it is called in the preface to the second edition. Ancillary studies on some of Boyle's contemporaries, such as Hooke, Lower, Mayow, and others, have also helped modern historians of science to define Boyle's role more precisely. Long before *The Sceptical Chymist* and Boyle's other important works were given the close study they have since received, it was fashionable to describe Boyle as 'the founder of modern chemistry,' although exactly how or why he merited this description was not made clear. He is now seen as an iconoclast whose work was indispensable in clearing the ground of unprofitable theories and beliefs which were obstacles to the advance of knowledge. Looking back from the perspectives of the twentieth century we can see how valuable this was; how it struck one of the generation immediately following Boyle's own is indicated by an allusion which seems to have escaped the extremely fine net in which Fulton caught

such a vast amount of biographical and critical comment relating to Boyle. This remark is to be found in *The London Tradesman* (1747) by R. Campbell, where he writes, "The honourable Mr. *Boyle* has writ much on this Subject [i.e. Chemistry], but he is voluminous; and it was the Misfortune of that truly great Man, that he was too credulous, and took many Things upon the Relation of others not sufficiently warranted by Experiments" (p. 61).* Voluminous he certainly was, and the method of composition and publication of his many writings were such that they cried out for the kind of patient and informed scrutiny which they were given by Fulton in order to elucidate all the problems which they present. They could have been a bibliographer's nightmare, but reduced to order and impeccably paraded as they are in this work they have been transformed into the material of a bibliographer's dream. Practically every kind of aberration and abnormality which can insinuate itself into the printed book by the laxity or impatience of the printer or the whim of the author can be demonstrated in these pages, together with the skilled treatment which clarifies the problem. Like many other difficult things, it seems easy once it has been accomplished.

The decision to produce an entirely revised edition is to be applauded. Not only does it incorporate the two separately published lists of addenda, but much other information collected since 1947. Among the additions is the record of Boyle's first published work, a twenty-page tract in a collection edited by Samuel Hartlib in 1655, and a hitherto unknown first edition (in Latin) of the *Rarefaction of the Air* (1670). The section of 'Biography and Criticism' is also greatly enlarged from 367 to 541 items. This having been said, it seems unnecessary to state that the first edition is now completely superseded and that it is to the new edition that all future reference should be made. Even the preface to this edition contains important new information about the fate of Boyle's library—a sad story which must make any scientific bibliophile weep, for when attempts to dispose of it by private negotiation failed, it was broken up and sold 'on the rails' at Moorfields, a fate worse than death for even the skeleton now defies reconstruction and all we know of his library at present is gleaned from the casual remarks of his friends and contemporaries and the very few books with his signature which have survived to our own day. The preface also underlines Boyle's important role in the founding of The Royal Society and in establishing its reputation abroad, for "it was Boyle who had been

* Another comment on Boyle from the same work was cited by Professor F. G. Young in a paper on "The Rise of Biochemistry" which he read at the Second British Congress on the History of Medicine in September 1961. It is to be found on p. 45 of Campbell's book: "It is necessary that he [i.e., the Physician] should be acquainted with the common Processes in Chymistry; but it would be rather lost Time to become an Adept in that fiery Study: There is little to be learned from it. Of this truth the honourable Mr. Boyle is a recent Example, who, after a whole Life spent in the most laborious Chymical Researches, has enriched the World with no more Medicines than what may be purchased, and that too dear, for Twelve Pence."

chiefly instrumental in determining the original five foreign members who were selected before formal incorporation of the Society on St. Andrew's Day, 1662, and . . . he came automatically to assume the role of the Society's unofficial foreign secretary, a post which was not formally created until 11 April, 1723." It was this association which led Fulton to plan the publication of this edition as a tribute to The Royal Society on its Tercentenary in 1960. As we all know, he was denied the joy of seeing the one or the other. However, the value of his work is too great and too lasting to need the borrowed light of an ephemeral festival to illuminate it. With its preparation was closely associated his friend and collaborator in many bibliographical adventures, Miss Madeline Stanton, by whose devoted care the proofs were purged of error to a degree which matches the importance of the work.

HENRY E. SIGERIST. *A History of Medicine.* Volume II. *Early Greek, Hindu and Persian Medicine,* edited by Ludwig Edelstein and with a preface by John F. Fulton. New York, Oxford University Press, 1961. $11.00.

Reviewed by LEONARD G. WILSON, *Assistant Professor of the History of Medicine, Yale University School of Medicine.*

THE publication of the second volume of Dr. Sigerist's projected eight-volume history of medicine demonstrates dramatically what a rich resource this series of books would have been had it been completed, and how great was the loss sustained in Dr. Sigerist's early death. Volume I presented the emergence of medicine in the context of the whole of primitive human culture. In his treatment of the medicine of the ancient civilizations of Mesopotamia and Egypt, Dr. Sigerist drew upon the entire range of their literature including that of religion, magic, and administration as well as their purely medical writings and brought to their interpretation his own unique combination of medical knowledge and experience united with human sympathy and insight. Now in his second volume Dr. Sigerist has applied the same comprehensive technique to the development of medicine in ancient Greece and India with results equally successful. His treatment of early Greek medicine is, by a broad margin, the best that has yet appeared in English. Nowhere else is the development of Greek medicine from Homeric times to the early fourth century to be found traced so fully, with such an imaginative synthesis of the medical references to be found in the sources.

After discussing the knowledge of anatomy revealed in the *Iliad* and the *Odyssey* and the information concerning the treatment of wounds given in these two works, Dr. Sigerist discusses the development of the cult of Asclepius with its curious blend of religion, magic, chicanery, and genuine healing. The evolution of Greek philosophy in the pre-Socratic period forms another theme which he shows is closely linked with the evolution of the

rational medicine of the Hippocratic corpus. One subject of which Dr. Sigerist gives hints in various places, but nowhere develops fully, is the influence which Mesopotamian and Egyptian ideas have had on the evolution of Hippocratic medicine. For instance he shows (p. 33) that the term *pneuma,* which was later to be considered the essence of life throughout the body and was to play a fundamental part in Greek physiology and medicine, had not yet come into use in the time of Homer. Instead the word θυμος (*thymos*) was applied to the principle of life. The *thymos* existed throughout the body and could escape from any wound, thereby causing death. Sometimes the *thymos* was thought to be located in the diaphragm. This seemingly minor point, which Sigerist just mentions, is very suggestive, for when the term *pneuma* came into use it was thought to be located in the heart and lungs, as befitted its nature, because *pneuma* means breath and it was thought of as the breath of life. Now the idea that the essence of life in the body is a breath is an oriental idea, as witness the numerous references to the breath of life in the Old Testament and in Mesopotamian literature.[1] The same idea is found in Egyptian medical writings and there the breath of life definitely has its location in the heart as well as the lungs just as it was to have in the Hippocratic and later Greek medical writings. The fact that the introduction of the term *pneuma* (as synonymous with life in the body) into Greek literature was late suggests that it was introduced as a result of the transmission of ideas from Mesopotamia or Egypt or both. These two small words *thymos* and *pneuma,* therefore, like chips floating on the surface of a great river, suggest the presence of intellectual currents both broad and deep.

Dr. Sigerist's discussion of Hippocratic medicine is particularly valuable because he not only distinguishes the man from the legend, but gives due importance to the legend. He traces its development and shows its effects, which have been for the most part beneficial. He traces, too, the development of the humoral theory and clearly relates it to the climate, geography, and endemic diseases of ancient Greece.

The only thing wrong with this delightful book, in fact, is that it ends too soon. It stops short of any discussion of the development of medicine at Alexandria in the Hellenistic period—developments associated especially with the names of Herophilus and Erasistratus—and of the medical teaching of Galen and others in the Graeco-Roman period. These were subjects which Dr. Sigerist intended to treat, as references in the present book clearly indicate, but his chapters on them had not been written prior to his death.

[1] E.g. Genesis 2:7 "And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul [or breath]". Cf. the vision of the valley of dry bones in Ezekiel 37:9-10. In the Egyptian literature the comprehensive role of the breath is suggested by the following passage: "As to 'the breath which enters into the nose:' it enters into the heart and lung; these give to the whole belly." B. Ebbell, *The Papyrus Ebers,* Copenhagen, 1937, p. 115.

Those who knew Dr. Sigerist were fortunate. For those of us who now can never have that experience his writings remain a permanent means of access to the resources of his personality and imagination and to his singular vision of what the history of medicine ought to be. To the list of his writings the present volume constitutes an invaluable addition.

THOMAS OSWALD COCKAYNE, Ed. (with a new introduction by Charles Singer). *Leechdoms, Wortcunning and Starcraft of Early England.* London, the Holland Press Ltd., 1961. Vol. I: xlvii, 450 pp. Vol. II: 360 pp. Vol. III: 239 pp. 16 gns.

Reviewed by DEREK J. DE SOLLA PRICE, *Professor of the History of Science, Yale University.*

NEARLY a century after their original publication, these three important volumes of Old English scientific texts now make a welcome reappearance. Outmoded prefaces and appendices have been trimmed away, and a magnificent new introduction has been provided. For this we have to thank the industry and wisdom of that doyen of our field, Dr. Charles Singer. This is, I believe, the last finished item from his pen to appear posthumously—I remember well discussing it with him at Kilmarth in the summer of 1958 and recall his hopes that more scholars would turn their eyes towards the peculiar medieval scientific texts which were written in the vernaculars rather than in Latin. The old edition of Cockayne had become rare, misleading in the light of new scholarship, and forbidding in its ugly nineteenth century convention of an overfaithful typographical transcription for the Anglo-Saxon runes. Singer has now given the old book a new lease of life.

The new introduction, though but 47 pages long, is in the best style of Singer and shows his mastery of the whole range of Anglo-Saxon medicine. The references to recent work (much of it by Singer and his collaborators) and the identifications of the texts and their contents are particularly valuable. Then again, who else but he could have written of "a disgusting little work on the badger" and "an equally nauseating book on medicines derived from animals"? It is also of some personal interest to learn details of the life of that obscure scholar, Thomas Oswald Cockayne, who first edited these texts. Born in 1809, he took a B.A. at St. John's College, Cambridge, at the age of 19, entered Holy Orders three years later, became curate of Keynsham, and then an assistant master at King's College School. For the rest of his life he must have worked in misery, several times reprimanded by the school governors, eventually dismissed under distressing circumstances, and dying by his own hand, unmarried, unappreciated, and in dire poverty. Yet he lived at the high tide of Germanic philology, published diligently as a member of the Philological Society, and now, through this great work, is remembered before most of those who chastised him.

The leechbooks, receipts, and herbals are well treated by Singer, and this reviewer can add nothing to their analysis. The star-cunning has, however, been neglected, and I therefore take advantage of this review to publish results of an enquiry made some years ago at Dr. Singer's request (he repeats it at the top of p. xxvi) that the 'horologium' text be examined from an astronomical viewpoint. This text from MS Cott. Tiberius, A iii, fol. 176, is the most interesting of the whole section. For 26 dates through the calendar year it gives the lengths of the shadows of a six-foot gnomon at noon and at 9 a.m./3 p.m., these being the Anglo-Saxon *tides,* dividing the day into four parts.

By graphical plotting one can show that the shadow lengths lie on a reasonably smooth curve, but with errors which may indicate that actual observation or graphical method has been used, rather than any exact trigonometric or arithmetic mode of computation. The noon curve shows a minimum of 3.7 feet at June 16th and a maximum of 24.7 feet at December 16th. From this, and taking a best fit to the curve, we find the latitude of observation is *c.* 54° (York; Bede's Jarrow is 55°), and that the inclination of the ecliptic is about 22°30′. It might be mentioned that this northerly latitude also appears in the construction of the famous pendant sundial, also Anglo-Saxon, found at Canterbury in the Cloister Garth, and in another similar specimen of less elegance seen by this reviewer at the British Museum. It is quite certain that none of these early sources can come from a place as far south as London.

Moreover from this same curve, the dates of the equinoxes and solstices, though given only approximately, enable one to date the observations as *c.* 1000 A.D. with a probable error of about 50 years, and therefore seemingly later than Bede (d. 735). This is especially interesting in view of the fact that the table of shadow lengths appears to have embedded within it the fragments of an earlier scheme. The 26 dates through the year are not distributed evenly. For about two months on either side of each equinox they are given at intervals of half a month (*c.* 15 days), the datum points in the months being the various 12th kalends and the midpoints between them. The region of the solstices is divided into smaller sections of *c.* 11 days each with a constant 4-foot shadow length for the summer solstitial interval. Now, this method of division appears to be late Roman in origin, the 12th kalends being conventional quarter-points at the time of the Nicene Council (325 A.D.) and the periods of *c.* 45 days around the solstices being reminiscent of the statement in Geminos that the Sun seemed to stand still for 40 days and nights at the time of turning. We thus have a late Roman (early Christian) conventional table of shadow lengths modified perhaps first by Bede from observations in the north of England, and then revised by a follower a couple of centuries later, possibly the writer of the manuscript.

O. NEUGEBAUER AND RICHARD A. PARKER. *Egyptian Astronomical Texts.* Vol. I: *The Early Decans.* London, Lund Humphries for Brown University, Providence, R. I., 1960. 134 pp., illus. £7.

Reviewed by ASGER AABOE, *Visiting Professor of the History of Science, Yale University.*

THIS is the first of three projected volumes in which Professors Neugebauer and Parker intend to gather all the available texts on Egyptian astronomy. It is highly desirable that this be done so that the precise state of our knowledge in this field may become readily available to anyone interested in the history of astronomy. This is particularly so in a subject like Egyptian astronomy which has been the victim of so much creative and imaginative speculation, and it is to be hoped that the appearance of these volumes will lay quite a few ghosts, for it appears that, contrary to many myths, Egyptian astronomy never managed to get beyond a most primitive and trivial stage. Incidentally, this makes the task of the editors a difficult one, for the more complicated an astronomical text is, the easier it is to find a unique interpretation.

The present volume is devoted to the early decans as they appear in the diagonal star clocks on coffin lids—there are 12 of them dating from the IX to the XII dynasty (i.e., from about 2150 to 1800 B.C.)—and to related later texts, viz., ceilings in the cenotaph of Seti I and the tomb or Ramses IV (about 1300 and 1150 B.C.) and the demotic commentary in *Papyrus Carlsberg I.* The texts are reproduced, transcribed, translated, and extensively annotated.

A diagonal star clock is essentially a table of 36 columns, each corresponding to a 10-day interval, and, as it happens, with each column containing 12 lines, each denoting one hour of the night. Each entry tells us the constellation, or "decan," which by its rising (later transit) announces a particular hour (line) during a certain 10-day interval (column). The decan which during the first 10-day "week" heralds, say, the last hour of the night, is so chosen that it will indicate the next to last hour during the second week and so on, and for all the decans. Thus a particular decan will wander up diagonally through the table, whence the name diagonal star clock. Some special arrangements are made for the 5 epagomenal days at the end of the 365-day Egyptian year, but we shall ignore them here.

Professor Neugebauer shows by a very elegant argument how the desire to have each constellation serve for a given hour during a *ten*-day interval forced the *twelve*-hour division of the night upon the Egyptians, and how this ultimately led to the 24-hour day which we still use today. A rough summary of his argument is as follows:

If each decan is to serve for one 10-day week to announce the first hour of the night, there must be 36 of them (we disregard here the 5 epagomenal days). This means that from sunset to sunrise 18 decans rise, and there are good reasons to assume that the first three and the last three

will rise unseen during twilight. This leaves us 12 decans to rise during the darkness of the night, each ushering in one hour.

From a text describing a shadow clock of a type of which several examples have survived we learn that 8 hours were measured by the shadow clock while 2 hours were allotted to each twilight period, giving in all a 12-hour division of the complement of the darkness interval in analogy to the 12-hour night. Out of this scheme grew the 12 + 12 seasonal hours, and ultimately the 24 equinoctial hours of Hellenistic astronomy which are still with us. It has then been shown that, crudely speaking, we have 24 hours a day because we have 10 fingers and the years 365 days.

The origin of the notion of decans, which was to play an important role in Hellenistic and later astrology, is also explained. For the most part the Egyptian decans cannot be identified, but from the additional fact that each decan is to be invisible for 70 days of the year like Sirius, which we learn from *P. Carlsberg I*, they can be assigned to a belt mostly south of, and roughly parallel to the ecliptic.

These are but a couple of the points made in this book, but suffice it to say here in general that it is of a consistently high quality, and this gives no surprise to anyone acquainted with its authors. The texts are beautifully reproduced, and in addition to the transcriptions, translations, and expert and exhaustive commentaries there are four useful appendices giving, respectively, an explanation of astronomical terms, the Egyptian civil calendar and rising of Sothis, concordance between Gregorian, Julian, and Egyptian dates, and Egyptian chronology. The volume is a most elegant folio in the style to which Egyptologists have become accustomed.

FRED B. ROGERS. *Help-Bringers: Versatile Physicians of New Jersey*. New, York, Vantage Press, 1960. 125 pp. $2.95.

Reviewed by WHITFIELD J. BELL, JR., Associate Librarian, American Philosophical Society, Philadelphia.

IN this unpretentious book Dr. Fred B. Rogers, professor of preventive medicine at Temple University, where he also lectures on medical history, has presented brief sketches of ten New Jersey physicians ranging in time from John Browne, who befriended young Benjamin Franklin (and whom Rogers identifies for the first time beyond the casual recollection of him in the famous *Autobiography*), to the pediatrician Henry L. Coit, who campaigned successfully for clean milk. Several of the sketches first appeared in the *Journal of the Medical Society of New Jersey*, and all bear the characteristics of such articles.

It is a varied gallery—Robert McKean, the S.P.G. missionary who became the first president of the Medical Society in 1766; Thomas Dunn English, more professional writer than physician, author of the popular romantic song "Ben Bolt," whose quarrel with Edgar Allen Poe ended

in fisticuffs and a lawsuit; Cyrus Fogg Brackett, professor of physics at Princeton University; Abraham Coles, whose abilities as a hymn-writer were warmly praised by Whittier; William A. Newell, member of Congress and governor of New Jersey and of Washington Territory, whose memory of a shipwreck on the Jersey coast drove him to advocate and win the establishment of the United States Life-Saving Service.

The author's sketches make clear what the title suggests, that eighteenth and nineteenth century physicians played a more prominent role in the political and cultural life of the community than their twentieth century successors. Of the first one hundred members of the New Jersey Medical Society, Dr. Rogers points out, 7 were clergymen, 17 became members of Congress or the legislature, 5 were elected sheriff, and 4 became judges. Rarely could an early American physician devote all his energies to curing the sick, because of the economic conditions of the profession; and because of the fluidity of American life, a physician seldom wanted to do so when he could. Not until the latter part of the nineteenth century, to judge by Dr. Rogers' sketches, did New Jersey physicians work and stay in the profession for which they were trained.

For each of the biographical sketches there is a list of the sources used. These are principally obituaries, editorials in medical journals, and such standard works as those by Wickes on New Jersey medicine. None of this, however, indicates the hours that went into locating John Browne's gravestone or Nicholas Belleville's portrait. One regrets, however, that no manuscript materials were consulted, for several of Dr. Rogers' characters were interesting and even important enough to deserve longer sketches and the sense of immediacy and authority which the use of manuscripts would have given. Most of the sketches are illustrated by a portrait of the subject.

PHILIP M. HAMER, Ed. *A Guide to Archives and Manuscripts in the United States.* New Haven, Yale University Press, 1961. xxiii, 775 pp. $12.50.

Reviewed by NATHAN REINGOLD, *formerly Senior Post-doctoral Research Fellow, Department of the History of Science and Medicine, Yale University.*

THIS book, a pioneering venture, sorely needs a critical apparatus. The *Guide* was compiled in two principal ways: from existing printed descriptions and from the responses to written queries. The quality of the entries, therefore, depends on the calibre and goodwill of diverse sources and informants; the editing has not, consequently, produced entries of a uniform level as is evident from a comparison of the cursory description of the Harvard Archives with the fairly full Houghton Library entry. Even allowing for such disparity, the compilation does bring into convenient compass material formerly scattered.

A wary reader should note that not all pertinent institutions are listed. Some notable omissions are the National Geographic Society, organizations at Woods Hole, the Burndy Library, and the Redwood Library at Newport. Nor should anyone expect that every collection, let alone every document, received coverage. The 394 Billings letters at the New York Public Library, the 547 S. L. Mitchill documents at the Museum of the City of New York, the E. D. Cope papers at the American Museum of Natural History, and the Henry Draper papers at the New York Public Library numbering about 200 items are not mentioned at all. These are cited specifically (there are many others), since statements on the dust jacket imply completeness and the introduction implies that *all* collections of over 50 pieces and/or for individuals of *DAB* rank were cited. Again the *Guide* was dependent on the thoroughness with which holdings were reported.

The entries themselves are simply the names of individuals or organizations with occasional notations of the subjects contained within a collection. To facilitate research, the compilers have frequently added notes about occupations and places of residence. Approximately 70 of the 1,300 institutions listed in the *Guide* have a million or more documents. Faced with such quantity and complexity, a scholar needs something more than a bare name; if only to understand why the documents deserve preservation, let alone use. The detail given is too often confusing or inaccurate. The 300 volumes in Syracuse University described as letters and other papers of early American natural scientists, 1775-1850, refer to the Smallwood Collection, a large portion of which is printed, not manuscript, material.

While comprehensive and useful, the index is not wholly reliable. It does not, for example, distinguish between Oliver Wendell Holmes, senior and junior. The latter is inaccurately described in the text as a Chief Justice of the United States. Nor should anyone assume that all medical practitioners are included under "Medicine, physicians." The index gives evidence of unimaginative compilation. The smaller the collection, the more likely it is that the description will be adequate. But since the value of manuscripts for research is liable to be proportional to the size of the collections, the result is to undervalue the larger and more complex collections.

Scholars will find the volume extremely useful and fascinating for browsing. Despite earnest efforts, it is not and was not really meant to be an alternative to the painstaking examination of individual institutions and collections, but a provocative first guide to largely unexplored historical treasures. The coverage for medicine and science, while not as good as specialists might desire, is nevertheless impressive, and the entries should facilitate and stimulate research.

ISAAC ASIMOV. *The Intelligent Man's Guide to Science* (Vols. I and II). New York, Basic Books, Inc., 1960. Vol. I, xiv, 382 pp., Vol. II, viii, 853 pp. $15.00.

Reviewed by MARTIN LEVEY, *Research Associate, Department of the History of Science and Medicine, Yale University School of Medicine.*

THE serious gap in our educational effort toward an understanding of science is widely recognized in these times. To remedy this ignorance of the "intelligent man" Mr. Asimov has boldly offered these two heavy tomes. He first treats of the physical sciences. Included are such general topics as the definition of science, the universe, the earth, the atmosphere, the elements, particles and waves, the machine, and the reactor. Volume two, on the biological sciences, covers the molecule, proteins, the cell, microorganisms, the body, and mind.

The book is full of information, much of it compressed to the point where the discussion becomes unclear. Perhaps it was commercial necessity which dictated the unfortunate decision to cover so broad a field in such limited space. This is to be regretted since Mr. Asimov has demonstrated elsewhere that he can make the subject material of science understandable to a wide audience.

The author has managed, however, particularly in the second volume, to offer explanation of the ideas which unify the facts. This is accomplished partly by the use of historical references and partly by mentioning new avenues being explored at the present time. Professor Asimov has introduced into his text many facts corollary to the main discussions. These should be useful and of great interest to high school teachers who may expand on them further. In my opinion these two volumes are valuable as an excellent source of interesting facts on science for older children.

The typography of the book is excellent; it is clear and extremely readable. The subject and name indexes are extensive. Also helpful are the fine illustrations and the bibliography. An appendix, purportedly on "Mathematics in science," should have been omitted.

SUESSMAN MUNTNER, Ed. *Moshe ben Maimun's Medical Works.* Jerusalem, Mosad Harav Kook. Vol. I: *Regimen Sanitatis; Letters on the Hygiene of the Body and of the Soul,* 1957, xviii, 254 pp. Vol. II: *Medical Aphorisms of Moses Maimonides in Twenty-Five Treatises,* 1959, xxxii, 468 pp.

Reviewed by MARTIN LEVEY, *Research Associate, School of Medicine, Department of History of Science and Medicine, Yale University.*

THESE volumes are the first in a series devoted to making the medical works of the great scholar and physician, Maimonides, more available to the historian of medicine. The first volume is concerned mainly with the Hebrew text of Fī tadbīr aṣ-ṣiḥḥa (*θ*. Regimen sanitatis) translated from the Arabic by one of the most famous Jewish translators, Moshe b. Samuel

b. Tibbon (*fl.* 1240-1283). It had previously been edited by Jacob ben Moses Ẓebi, *Dibre Mosheh* (Warsaw: 1886), by Jacob Saphrir ha-Levi *Sefer hanhagat haberī'rīt* (Jerusalem: 1885), and by H. Kramer, "Die medizinische Schwanengesang das Maimonides, *Fī Bajān al-A'rād,*" in *Janus* (1928, *32*, 12-116; Arabic text and German translation).

Maimonides composed this treatise "On the Regimen of Health" in 1198 for his sovereign, Sultan Nūr ad-Dīn 'Alī, who was the oldest son of Saladin. This book, probably the most original and important of Maimonides' medical writings, enjoyed a great success during the Middle Ages in Europe in Latin and Hebrew translations.

For comparison with Maimonides' work, the Kulīyat aṭ-ṭib, part 6 (being on the regimen of health) of ibn Rushd (1126-1198) is given in the Hebrew translation of Yaskov Hagatan from the original Arabic. From a quick examination, the superiority of Maimonides' account may easily be seen.

Muntner has added a table of the materia medica found in the text so that some of the difficult botanicals are accurately designated. There are some errors in the Hebrew, Arabic, and Latin names in this list arising from a lack of comparison with Arabic usage. These, however, are minor; the difficulty of typesetting is enormous.

Further appendices, the "Book of Science" by Maimonides, and extracts from the "Eight Chapters" by Maimonides, are given. A section on psychosomatics by Muntner is also included as an appendix.

The preface (4 pp.) and the introduction (9 pp.) are in English. Very full indices in English, Arabic, Greek, and Hebrew (one index for the ibn Rushd work and one for Maimonides' main text) are provided. These indices round out a full ambitious work. It is my hope that Dr. Muntner will be able to carry out his plan to publish the original Arabic texts of the medical works on Maimonides.

The second volume under review is the 1283 A.D. translation by Rabbi Nathan Hameati of Fuṣūl Mūsā fi'ṭ-ṭibb (Medical Aphorisms of Moses). Many copies of the Arabic and Hebrew texts are known so it must have been very popular in its day. The best known copy is that in the hand of Maimonides' nephew, Yūsuf ibn 'Abdullāh, made in 1205 A.D. eight months after the death of his uncle. No critical Arabic text, unfortunately, has yet been published. The Latin translation of the thirteenth century was later printed in 1489. This translation exercised an important influence in the European medicine of the Middle Ages.

Much of the latter part of the text, especially the 25th chapter, is devoted to criticisms of Galen, and to an appreciation of the medical learning of al-Fārābī, ibn Zuhr, at-Tamīmī, and ibn Ridhwān. The first 24 chapters contain a rich collection of medical rules selected from Galen and other physicians. This work, except for the last part, is not one of Maimonides' most original works. It is to his credit, however, that he pre-

sented methodically his knowledge of such diverse fields as anatomy, balneology, gymnastics, gynecology, pharmacology, physiology, semiology, surgery, and others. Dr. Muntner, in his battle with the difficult mediaeval Hebrew, has done an exceptional piece of work in his explanatory Hebrew and English notes.

In his book, Maimonides tried to eradicate prejudices and superstitions held by contemporary physicians and attempted to lead them to a greater open-mindedness toward mediaeval tradition. He did not neglect to include the exact references to Galen so that the work served as a repertorium of Galen for two hundred years. In fact, Johannes de Tornamira (1329-1396), a famous Montpellier physician, recommended this book and called it "Flores Galieni." Maimonides hinted at the pulmonary (lesser) circulation by emphasizing the connection between the right ventricles and the lungs. He also discussed diseases such as diabetes, trachoma, cholelithiasis (?), trichophytia, and lymphogranulomatosis.

It would be a further contribution to the history of medicine if this work were to be translated into a modern language. Some of Galen which is lost is probably here included. Many references to works and authors as well as developments in Arabic medicine are described. There is much significant material for those interested in the later development of the objective approach in science. Many of these ideas, although originating in the mediaeval Arabic and Hebrew Golden Period, are sometimes attributed to Roger Bacon who lived about 50 years after the death of Maimonides.

This volume also is excellently printed. The preface and introduction are in Hebrew and English. The indices are very useful and seem to be complete. Many of the notes also give the English for mediaeval Hebrew technical words. The publishers and the co-operating Hebrew Medical Association are to be congratulated on this very important project.

G. J. GOODFIELD. *The Growth of Scientific Physiology. Physiological Method and the Mechanist-Vitalist Controversy, Illustrated by the Problems of Respiration and Animal Heat.* London, Hutchinson [1960]. 174 pp. 18s.

Reviewed by DIANA LONG HALL, *Department of History of Science and Medicine, Yale University.*

THIS short book has a long title and a threefold purpose which Miss Goodfield spells out clearly in her conclusion (p. 156):

The story we have been telling has three strands. First there is the gradual emergence of a scientific physiology, with its own concepts, methods of inquiry, and types of explanation. Second, there are the philosophical debates which developed in the course of this emergence, concerning the legitimacy of using (or rejecting) experimental and quantitative procedures in physiology, or admitting physico-chemical (or non-physico-chemical) concepts into physiological explanations. Finally, as an illustra-

tion of the practical applications of these apparently somewhat abstract issues, there is the progressive clarification of men's ideas about the origin and control of animal heat.

Miss Goodfield has much insight into all three problems, which I shall discuss in reverse order. She can, as she says (p. 113), see the stages of development of the study of animal heat, "where results and ideas and methods were pulled together into a coherent framework." Her chapter on "Theories of Respiration and Animal Heat up to the 1830's" is excellent. She states the three problems which faced physiologists at the turn of the nineteenth century (p. 76):

> whether . . . carbonic acid has a smaller capacity for heat than oxygen, so that heat is released when oxygen is converted into carbonic acid; whether the capacity of arterial blood for heat is greater than that of venous; and whether the temperature of the blood is the same in both sides of the heart and in the main vessels of the pulmonary circulation.

She then picks one question, "whether any oxygen at all was absorbed into the blood" (p. 81), which is fundamental to all three problems. She shows how physiologists vacillated on this proposition as each new experimental result came in—and in the 1830's experimental results were coming in rapidly. The documents of this period are full of confusion and uncertainty, but Miss Goodfield handles them adroitly, distinguishing what they do say from what they leave unanswered. An example is her comment on J. K. Mitchell's "On the Penetrativeness of Fluids," (p. 90):

> These experiments removed much of the doubt whether it was possible for oxygen to penetrate into the blood *in the lungs.* But it had still not been demonstrated that oxygen could be found in the arterial blood *throughout the course of the circulation,* and it had been shown that carbonic acid as such was *not* present in the serum.

One other unusually perceptive paragraph must be cited, her comparison of Lavoisier and Adair Crawford which follows the discussion of their most important papers. (*Explication de texte* is Miss Goodfield's forte.) She says (p. 55): "Lavoisier . . . was concerned to show only that a qualitative and quantitative analogy existed between respiration and combustion. . . . But Lavoisier was not concerned, as Crawford was, with the actual mechanism by which the heat was evolved."

Lack of biographical detail to explain how and why these stages were achieved is Miss Goodfield's primary failing. Another is her overemphasis on the continuity of the mechanist-vitalist debate. She says for example (p. 13), "Though the terrain of the debate has shifted . . . at each epoch one finds a similar division of opinion, between 'mechanists' on the one hand and 'vitalists' on the other." Both the mechanist and vitalist positions changed radically between the time of Lavoisier and Bichat and the time of Liebig and Claude Bernard. At this latter date, Goodfield says (p. 113), "the ideas of animal heat and the fundamental methodology of modern

physiology were rounded off . . . by the work of Liebig and Claude Bernard—one [the former] a vitalist, and the other a mechanist." But who was really the mechanist and who the vitalist? Liebig said of the vital force that the term had "been invented merely for the purpose of concealing ignorance."[1] Bernard remarked that "during its lifetime, the living being remains under the influence of this . . . creative vital force, and death arrives when the force can no longer manifest itself."[2] I insert these quotations only to underline the ambiguity of the positions of the two great physiologists concerning the vital force, an ambiguity which Miss Goodfield recognizes but ignores. Liebig, she points out, tried to measure a vital force, while Claude Bernard encouraged the study of the physico-chemical environment of organs, the *milieu intérieur*. But Liebig acted as a mechanist. His "account of the chemical transformations which took place in the body during [the] conversion of food into [carbonic acid]" (p. 118) began the German biochemical studies of metabolism which considered the quantitative physico-chemical approach the *sine qua non* of physiology. Bernard's internal environment, on the other hand, did not receive precise study or justification until the work of L. J. Henderson and W. B. Cannon in the twentieth century. Seeing them in terms of an ever-recurring mechanist-vitalist debate, Miss Goodfield has forced both Liebig and Bernard into positions they did not hold.

The story of physiology is too large to be adequately treated in such a short work. Miss Goodfield's contribution is challenging to historians of science. It offers first a blueprint of the history of respiration and animal heat and the key questions involved, and second, a recognition of the complexity of historical as well as scientific physiology.

FREDRICK A. WILLIUS. *Henry Stanley Plummer—A Diversified Genius.* Springfield, Illinois, Charles C Thomas, 1961. viii, 71 pp., illus. $4.50.

Reviewed by HERBERT THOMS, *Professor Emeritus of Obstetrics and Gynecology, Yale University School of Medicine.*

DR. Fredrick A. Willius of the Mayo Foundation in his book of 71 pages presents an informative biography of his former friend and associate, Henry Stanley Plummer, who for 36 years until his death in 1936 was prominent in the affairs of that organization. Dr. Plummer was a pioneer in many medical fields—x-ray diagnosis and therapy, thyroid disease, cardiology, pneumotherapy, to mention some. He was appointed professor of medicine soon after the establishment of the Foundation and made an outstanding contribution to the development of the clinical laboratory and the medical library.

[1] Justus Liebig, *Chemistry in its application to agriculture and physiology*, in his *Complete works on chemistry*, Lyon Playfair, Ed. Philadelphia, 1852, p. 26.

[2] Claude Bernard, *Introduction à l'étude de la médecine expérimentale*, Paris, F. Levé, 1900, p. 148 (my translation).

The subtitle of Dr. Willius' book is more than a happy phrase, for Dr. Plummer's acumen in the fields of architecture and mechanics easily rivalled his talents in medicine. He became in many ways the master builder of the Clinic, introducing innovations in construction and administration at a time when by modern standards the patterns were largely primitive. The new Clinic Building erected in 1929 is modern for our own time and now appropriately known as the Plummer Building.

Dr. Plummer's cultural interests were also many and included music, classical literature, and history. "The varied interests of Henry Plummer," says Willius, "and his diversified store of knowledge seem almost unbelievable, yet I lived in this era and witnessed all these accomplishments as realities."

Dr. Plummer was an enthusiastic yachtsman and the final chapter of this book gives in some detail a log record of a 33-day trip made in 1936 in his cabin cruiser from Bayonne, New Jersey, to Wabasha, Wisconsin. Dr. Willius tells the story of Dr. Plummer in a positive if modest way and makes his subject a human being as well as a distinguished physician.

UNIVERSITY LIBRARY, CAMBRIDGE. *Handlist of Darwin Papers at the University of Cambridge.* Cambridge, 1960. 72 pp. 10s.

Reviewed by LEONARD G. WILSON, *Assistant Professor of the Department of the History of Medicine, Yale University School of Medicine.*

THIS little booklet offers a guide to the personal papers of Charles Darwin in the Cambridge University Library where they were placed after the war through the generosity of the Pilgrim Trust and the Darwin family. It is a collection of papers of the greatest importance, and this guide will help to make it much more readily available to scholars throughout the world than it otherwise would be.

The collection includes the notebooks and diaries kept by Darwin during the voyage of the Beagle, the original manuscripts of his books, and many letters written to him—to mention only a few of the different kinds of items. Consequently, these papers must be a most important source for any critical biographical study of the history of science in the nineteenth century.

KAROLINSKA INSTITUTET. *The Royal Medical School in Stockholm.* Stockholm, Göteborg, Uppsala, Almqvist & Wiksell, 1960. 102 pp.

Reviewed by THOMAS R. FORBES, *Associate Professor of Anatomy and Associate Dean, Yale University School of Medicine.*

THIS attractive illustrated booklet describes the Karolinska Institutet, one of Sweden's four medical schools. A brief section on each department relates its history, mentions personnel, and outlines teaching and research activities. The faculty (a committee of which is entrusted with the selection

of Nobel prize winners in physiology and medicine) includes such renowned scientists as Sjöstrand, Theorell, Caspersson, the von Eulers, Luft, and, until his recent death, A. Westman. Each year 140 students are admitted for the study of medicine.

This anonymous volume is well written and interesting.

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Hygeia: A Mid-Victorian Dream of a City of Health

JAMES H. CASSEDY*

PASSAGE of the great Public Health Act of 1875 was, for British sanitarians, both a climax and a beginning. Four decades of reformers had tirelessly preached, argued, cajoled, and worked hard in order to get to the point represented by this achievement. In the ranks of reform there had been members of the nobility like Lord Ashley, statisticians like William Farr, clergymen like Charles Kingsley and Frederick D. Maurice, physicians like Southwood Smith and John Simon, bureaucrats like Edwin Chadwick, and hundreds of anonymous zealots who belonged to the Health of Towns Association.

The common mission of these men had been a frontal assault of almost unprecedented energy upon various of the evils of industrialism—an earnestly dedicated and highly organized effort to create a healthier world.[1] It was the dogmatic Chadwick, coming to grips with the appalling excess of death and disease which everyone had noted among the poor of the squalid cities, who had evolved the formula around which all could rally in making this assault. This was his "sanitary idea." The excesses of death and disease were largely preventable, Chadwick had pointed out, since they resulted from environmental conditions of filth and dirt which were removable.[2]

Sanitary reformers before 1875 had labored to perfect the means—technical, administrative, and legal—of removing these monstrous conditions of filth. The Public Health Act of 1875, though not everything that the reformers had asked for, was still the touchstone of their efforts. Consolidating the accumulated sanitary laws and agencies, and extending further than ever before the areas of public sanitary authority, it was a glorious success for the promoters of Chadwick's sanitary idea.

With this success, British sanitarians and lawmakers set a pattern of sanitary action which would remain largely intact up

* Pakistan-American Cultural Center, Karachi.

1 See, for example, René Dubos' assessment in *Mirage of health*, New York, 1959, pp. 182-183.

2 Edwin Chadwick, *Report . . . into the sanitary condition of the labouring population of Great Britain*, London, 1842.

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until just before World War II.[3] At the same time, the Act provided a vantage point from which the sanitary philosophers of the 'seventies could look out upon the far-reaching potential of their handiwork. From such a point their vision would no longer be confined by the strict realities of reeking, filth-piled streets in the industrial city. On the contrary, they could now soar somewhat above all this to imagine the ultimate application of the sanitary idea.

One prominent Victorian in particular pursued this vision in a notable way. This was the famous physician and sanitarian Benjamin Ward Richardson. In the fall of 1875, soon after passage of the Public Health Act, Richardson shared his view of this vision with his fellow sanitarians. The scene was the channel resort of Brighton. The occasion was the annual meeting of the Health Section of the Social Science Association. Upon this occasion Richardson, President of the Health Section, delivered his memorable address on "Hygeia: A City of Health."[4]

> It is my object [he told his listeners] to put forth a theoretical outline of a community so circumstanced and so maintained by the exercise of its own freewill, guided by scientific knowledge, that in it the perfection of sanitary results will be approached, if not actually realised, in the co-existence of the lowest possible general mortality with the highest possible individual longevity. I shall try to show a working community in which death . . . is kept as nearly as possible in its proper or natural place in the scheme of life.[5]

An idealistic projection of the sort which Richardson went on to make was nothing unusual in a country which had the original *Utopia* of Sir Thomas More as well as Bacon's *New Atlantis* in its literary tradition. Nor was its appearance entirely a novelty to a mid-Victorian generation which had already enthusiastically thrown itself into the imaginary worlds of Robert Pemberton's *The Happy Colony,* Bulwer-Lytton's *The Coming Race,* and Samuel Butler's *Erewhon.* True, none of the authors of these imaginary worlds had placed their main emphasis upon hygiene. Still, More had particularized a society in which the prevention of disease was more valued than the curative processes and in which temperate living along with excellent hospitals and enlightened sanitary measures brought a maximum of health and longevity. Bacon, on the other hand, had imagined the scientists

3 The Public Health Act of 1936 is considered as the "successor" to the Act of 1875. W. M. Frazer, *A history of English public health,* London, 1950, p. 120.

4 Benjamin Ward Richardson, *Hygeia: A city of health,* London, 1876.

5 *Ibid.,* pp. 10-11.

of New Atlantis as performing remarkable feats of curing disease by their medicines, prolonging life by their artificial waters of Paradise or air chambers, and preventing infectious diseases by a certain orange-like fruit. Bulwer-Lytton had portrayed a race of stalwart seven-footers whose health remained perfect throughout a long and somewhat indolent life of 100 to 150 years and who fought disease effortlessly through the remarkable properties of "vril." Butler, in his turn, had shown physical illness in the light of an immoral crime, sometimes even subject to capital punishment, and he had satirized physicians as the underworld of *Erewhon.*

Outside of England, too, utopian worlds had appeared in literature at various times since Plato's *Republic,* and these had equally varying plans for medicine and hygiene. St. Augustine had pictured a *City of God* which, almost by definition, had little need of medicine or sanitation. Campanella's *Heliopolis,* however, was a somewhat more down-to-earth place which honored the special wisdom of medicine and physiology, for great longevity had been achieved there, and illness was rare. Sebastien Mercier, who was a follower of Rousseau, proposed, in *L'an deux milles quatre cent quarante,* such excellent medical arrangements for his utopia as active medical research, an enlightened system of hospitals, and a vaccination clinic or institute. But probably the utopia in which attention to medicine and hygiene had been carried farthest was that of Etienne Cabet's Icaria. In his *Voyage en Icarie* of 1840, Cabet envisaged such things as a central public health administration, superior hospital services for all sections of the city, medical training at public expense, immaculate streets, and universal dental care. Under the impact of improved science and technology, together with the increasing revolutionary fervor to remold society for the benefit of the many rather than the few, the utopian writings of the eighteenth and nineteenth centuries multiplied enormously, and in many of these the public health was a matter of prime concern.[6]

Benjamin Ward Richardson's *Hygeia,* however, is noteworthy among utopias in being devoted exclusively to a promised land of health. Like several of the other utopias, the work stresses the preventive rather than the curative ideal, and almost surely it is

[6] The medical content of representative utopian literature from Homer and Plato to Bellamy's *Looking backward* and slightly afterward is discussed in two articles by G. Kasten Tallmadge and one by George Rosen collected under the title of "Medicine in nowhere," *Ciba Symp.,* 1945, 7, 166-200.

the most elaborate of any in setting forth an imaginary public health program. There is no indication whether or not Richardson was familiar with such utopias as those of Campanella, Mercier, or Cabet when he sat down to write his Brighton address. It is hard to imagine, however, that he had not, sometime in his career, read *Utopia* and the *New Atlantis*. There are some passages which even suggest that he may have had his copy of *Utopia* close by when he wrote *Hygeia*. Yet, in the main it appears that Richardson received his inspiration from a source which was not out of the past but close at hand—i.e., the still active sanitary movement as propelled by Chadwick's sanitary idea. The result was a hopeful projection of an ideal toward which English society had already taken large strides.

Richardson made no attempt of the kind that More as well as Bulwer-Lytton and Butler had made, to paint the broad political, economic, and social outlines of an ideal community. His effort was much closer in scope to the limited range of Bacon's scientific college. In spirit it is close to Cabet. Richardson's paper simply proposed a technician's blueprint for a sanitary utopia, roughly within the framework of existing English political and social institutions. The carrying out of such a utopia implied the necessity of riding over Victorian individualists such as Herbert Spencer through additional social and governmental controls. Yet, at the same time, in Richardson's humanistic view, this would in no sense demand that degree of authoritarian discipline which many other utopian writers, such as Edward Bellamy, seemed to think desirable.[7]

Richardson went to Brighton in 1875 not to entertain the delegates but to impart something of the missionary fervor which he himself brought in extra measure to the sanitary movement.[8] His vision of Hygeia was no idle fancy. It was the result of a conviction of several decades about a development which, he was certain, lay within man's present capabilities. "Mr. Chadwick has many times told us," Richardson reminded the assembly, "that he could build a city that would give any stated mortality, from fifty, or any number more, to five, or perhaps some number less,

7 See Marie Louise Berneri, *Journey through utopia*, Boston, 1951, pp. 1-8, *passim*.

8 In his autobiography, however, Richardson relates that he went to Brighton with two addresses in his briefcase. The one which he chose not to deliver was colorlessly entitled "The statistics of death rates." B. W. Richardson, *Vita medica*, London, 1897, pp. 235-240.

in the thousand annually."[9] Richardson went on to show his colleagues how to build a city which would achieve the lowest of these figures.

Benjamin Richardson was well qualified to act as prophet for the sanitary idea. Still in his forties in 1875, he had already made his name in medical practice and had been President of the Medical Society of London. As a teacher of medicine, he had presented (in 1855) the first course of lectures in England on modern public hygiene. By no means as much of a scientist as his contemporary, the German sanitarian Pettenkofer, Richardson nonetheless had made valuable contributions as an experimentor, particularly with his researches on anesthetics. He was even more widely known as a forthright humanitarian for his work in furthering the use of anesthetics for both men and animals. While busying himself productively with many of the details of sanitary work, Richardson had invented the metal dustbin, had tirelessly taught Victorian matrons the proper care of water closets, had tried to synthesize milk and food-stuffs in his laboratory, and had come up with various grandiose and idealistic projects such as his proposal for draining the entire country through a vast system of sewers and drains along the nation's railroad lines. Also by 1875 Richardson had already begun his strenuous advocacy of total abstinence as his answer to one of the country's most pressing public health problems.

Every inch the resourceful reformer, Richardson was also a prolific writer. Although his output included plays, poetry, and songs, his best writings were his many scientific papers in the *Lancet* and the *Medical Times and Gazette*. He himself had been originator (in 1855) and editor of the *Journal of Public Health and Sanitary Review*, the first British periodical on the subject. For the first number of this journal, Richardson devised a motto which became the byword of the sanitary revolution in England: "National Health is National Wealth."

Unquestionably, Edwin Chadwick never had a more devoted or more enthusiastic disciple than Benjamin Richardson. All of Richardson's many talents were placed at the service of the other's sanitary idea. As was to be expected, he dedicated *Hygeia* to Chadwick and later in life he was to become Chadwick's conscientious biographer.[10] Serene and unshakable in his faith in

[9] Richardson, n. 4, p. 17.
[10] B. W. Richardson, *The health of nations*, London, 1887. 2 vols.

public sanitation, there was no better person than Richardson to depict the outlines of the City of Health.[11]

Hygeia, as Richardson revealed it at Brighton in 1875, was a community of which not only sanitarians but even city planners could have been proud. Not a true "garden city," it could nevertheless have served well as inspiration for those planners of a few decades later who devised that concept as an antidote to urban blight.[12] Richardson limited his city to 100,000 persons. He provided, moreover, a limit of 25 persons per acre and houses which should not exceed four stories in height. For maximum ventilation and sunlight, every house had its own ample garden in back. Even public buildings were invariably surrounded by lawn and garden space.

The paved streets, of course, were spaciously wide and were kept spotlessly clean. They were washed daily, and debris was carried away beneath the surface. To eliminate noise and accidents, surface streetcars were eliminated in favor of an underground railway system.

Individual houses in Hygeia were built uniformly on brick arches in order to ensure good drainage and ventilation. For the same reason, wall bricks were perforated in order to allow constant circulation of air at all times and in winter to help in heating. Interior wall bricks, which came in various colors, were glazed for ease of washing and so that unsanitary wall papers with their poisonous pastes could be avoided.

There were no dank cellars or evil basement habitations about which the Dickens of the City of Health could moralize. All rooms were above ground. Reversing normal practice, Richardson placed the kitchens on the upper floors. There they were lighter and cleaner, and odors disappeared more quickly than when they were on the bottom floor. Bedrooms were large, airy, well lighted, and kept free of all unnecessary furniture. Similarly, unsanitary, dirt-catching carpets were never laid on living room floors. Bedrooms as well as bathrooms were provided with hot and cold

11 For a concise biographical account see "Richardson, Sir Benjamin Ward," *Dictionary of national biography*, suppl. III, pp. 297-298. Richardson's biographer, Sir Arthur Salusbury MacNalty, *A biography of Sir Benjamin Richardson*, London, 1950, draws heavily upon Richardson's own autobiography, *Vita medica*. Richardson's daughter, Mrs. George Martin, wrote a short appreciation, "Life of Sir Benjamin Ward Richardson, M.D., F.R.S.," in a posthumous collection of Richardson's essays, *Disciples of Aesculapius*, London, 1900. Sir Arthur Newsholme, *Fifty years in public health*, London, 1935, pp. 102-106, provides a more critical short evaluation.

12 These planners, who themselves were often regarded as being utopian, include British leaders like Ebenezer Howard and Raymond Unwin and, later, Americans like Henry Wright, Clarence Stein, and Benton Mackaye.

water taps, while a continuous water supply and carefully designed plumbing eliminated the danger from the sewer gases which Victorians feared so much. It went almost without mention in 1875 that all houses were serviced by underground water, gas, and sewerage pipes.

The means of ensuring clean soil, clean water, and clean air for the citizens of Hygeia were far in advance of Victorian realities. The filtered water supply of the city was tested twice every day, while a large generator passed ozone into the drinking water whenever an excess of organic impurities existed. Scavengers came around early every day to remove garbage and refuse in closed vans. Sewage was disposed of on sewage farms far out of town. Similarly, noisy factories, laundries, slaughter houses, and other offensive trades had to be located outside of the city. The conduct of such establishments, of course, as well as the raising of animals for meat, was carefully supervised.

In various respects Hygeia would have been a Methodist's delight. By ways which Richardson left unexplained, the use of tobacco had totally disappeared. Similarly, the citizens miraculously seemed to have lost their thirst for alcoholic beverages.[13] This presumably had eliminated alcoholism, while it had also caused a great decline in the number of the insane.

If Richardson accomplished these results in Hygeia largely by wishful thinking or by unspecified administrative fiat, he was much less vague about the actual presence of sickness and how to prevent or deal with it. Drawing from the experience of the sanitary revolution, he could picture the "principal sanitary officer" of Hygeia at the head of an entire hierarchy of medical officers, registrars, sanitary inspectors, chemists, and scavenging personnel. This body of men enforced all of the meticulous sanitary rules of the city, which began with providing for the basic cleansing needs and went on to cover such things as the use of public buildings, the conduct of funerals and burials, and working conditions in various trades. Textile workers, for one example, were not allowed to take any of their work to their homes, so that diseases in their families would not spread to the purchasers.

To inhibit the high infant mortality which was the plague of the nineteenth century, Richardson suggested a large number of

[13] Sir Thomas More, similarly, had planned a city which, hopefully, would have ". . . no taverns, no ale-houses, no stews. . . ." More, "Utopia," in *Famous utopias*, Charles M. Andrews, Ed., New York, n.d., p. 179.

public homes where trained nurses would care for infants and small children. For the rest of the populace of Hygeia there was a system of model hospitals, unique in some respects but reminiscent of the plans of More, Mercier, and Cabet. More had envisaged four hospitals for every city in Utopia, while Mercier had proposed twenty for his Paris of the future. Richardson, going further, provided twenty small hospitals for his city of only 100,000, one for each 5,000 persons. No expense was spared. Everything that was new in the 1870's was provided. There were training schools for nurses, steam heat in all rooms, ambulance service, effective out-patient service, and individual rooms for every seriously ill patient. Taking into account the current belief that disease was readily spread by fomites, Richardson provided that the walls of the hospital rooms be removable and replaceable if they became infected.

In brief, in Hygeia Richardson would have a community scrubbed as clean as the kitchen of any Dutch housewife. It was to be clean because at the same time it would be enlightened—a city of public baths, swimming pools, and gymnasia alongside its schools, libraries, and lecture halls. Richardson would have the city purged of all of the blemishes which bothered the Victorian reformers. He would have it laid out and planned down to the last livery stable and sink stopper. He would have it sterilized, inspected, and regulated as no city ever had been. Here was the ultimate in man's long battle to rid his cities of the filth and bad smells which seemed to cause disease. Chadwick and his disciples did not believe in halfway measures, for only thoroughness could achieve striking sanitary results.

There was no doubt, Richardson asserted, that results would be spectacular in Hygeia. To be sure, he could see no prospect that the incidence of pneumonia, bronchitis, or similar diseases would be any lower than in actual municipalities. Likewise, even in this ideal community, cancer and other degenerative diseases would be the same as elsewhere, as would such endemic diseases as scarlet fever, measles, and whooping cough. On the other hand, the City of Health would see pulmonary consumption, the greatest single killer of the period, reduced by about one-third. Further, there would be little or none of the devastating infant diarrheas and croups. Liver diseases, delirium tremens, scurvy, and death by privation would be unknown. There would be no smallpox, puerperal fever, rheumatic fever, or heart disease. Finally, the

city would be totally free from the danger of visitations from those potent filth diseases, typhoid fever, typhus fever, and cholera.

With such an absence of disease, Richardson could confidently predict, for the first generation of inhabitants of Hygeia, the astounding average mortality of only eight per thousand per year. In subsequent generations the average would be down to five per thousand. This was truly an incredible forecast for a year when the actual crude mortality of England was 22 per thousand.[14] But Richardson had been looking back to the beginning of the sanitary revolution, when the mortality in an industrial city like Manchester had been a gigantic 33 per thousand and in Liverpool, close to 35 per thousand.[15] If there had already been such a vast improvement within 35 years, did the prediction for Hygeia seem preposterous? Richardson asked the delegates at Brighton to believe with him that his view of Hygeia was no "mere dream." The details of the city had been evolving in concrete form, he pointed out, through the work of Chadwick and the other sanitary pioneers, over the past three or four decades. It was, as he said, up to subsequent generations of the reform to fit the details together in order to achieve Hygeia.

> We shall continue to work successfully for its realisation. Utopia itself is but another word for time; and some day the masses, who now heed us not, or smile incredulously at our proceedings, will awake to our conceptions. Then our knowledge, like light rapidly conveyed from one torch to another, will bury us in its brightness.[16]

Hygeia has not yet, of course, in the decades since 1875, been constructed in the form which Richardson projected. Yet, fantastic as they seemed at the time to many people, some of his objectives have at least been approached in England, the United States, and other countries. Certainly, marvelous improvements in the mortality rate have been registered. From the still considerable mortality in England in 1875, deaths had dropped to about 11.6 per thousand by 1940.[17] In the United States there was a comparable decline to the point where a figure of less than 10 per thousand was reported by 1950.[18] In both countries, a whole list

14 *Population Policy in Great Britain.* Unsigned report. London, 1948, p. 43.
15 George Rosen, *A history of public health,* New York, 1958, p. 202.
16 Richardson, *Hygeia,* p. 47.
17 *Population policy in Great Britain,* p. 43.
18 See, for example, Walter F. Willcox, *Studies in American demography,* Ithaca, New York, 1940, pp. 216-217; also, *Information please almanac, 1960,* New York, 1960, p. 344.

of the diseases of 1875 had practically disappeared by 1940, while longevity expectancy had increased phenomenally.[19]

Just what part Richardson's talk on Hygeia played in helping to bring all of this about is problematical. Certainly it was a memorable oration to all those who heard it. Both British and continental newspapers reported it at length. Subsequently, the message of the City of Health spread even further when it was published in pamphlet form the following year. Uncounted numbers of young British doctors and sanitarians read it and were permanently impressed. Rich old ladies began to build "Hygeian residences"; tradesmen advertised Hygeian goods.[20] Busy Fabian reformers incorporated elements of Hygeia into their plans for national health services. Arthur Newsholme, at the beginning of a brilliant career as a medical officer of health, belittled the prediction of a death rate of five per thousand and criticized Richardson's generally loose of statistics, but he admired Richardson's dramatization of the "possibilities of healthier life."[21] Across the Atlantic, too, *Hygeia* was enthusiastically received, especially in cities where important sanitary work was being done—New York, Boston, Providence, and Baltimore. The great pathologist Edward Janeway, who was also a Health Commissioner of New York City, was among those who felt that the sanitary vision expressed in *Hygeia* was not farfetched. "The city there described," he asserted in 1880 to a group of American sanitarians, "Utopian at present, will be approached in the future."[22]

Beyond a doubt the idealism of Richardson's views was contagious. Yet, almost as soon as it was so brilliantly set forth, a new idealism began to compete for the public attention. With the discoveries of Koch and Pasteur in 1876, the germ theory of disease began to take on greatly increased validity and potency. From that date on, the hopeful promise of the sanitary idea was steadily combined with or replaced by the optimistic outlook of the contagionists. It was soon Pasteur as much as Chadwick or Richardson who held the stage with the claim that "It is within the power of man to rid himself of every parasitic disease."[23] It did not happen overnight, but after 1885 sanitarians increasingly

19 See Dubos, *Mirage of health*, pp. 143-149, 156-165.
20 Richardson, *Vita medica*, p. 239.
21 Newsholme, *op. cit.*, p. 104.
22 Edward G. Janeway, "Remarks," *Public health: Papers and reports of the American Public Health Association*, 1880, V, p. 48.
23 Louis Pasteur, quoted in Irving Fisher, *Report on national vitality*, Washington, 1909, p. 14.

became oriented to the laboratory and looked to the man behind the test tube rather than to the clean-up man for the key to that "perfect control" of infectious diseases which they expected to achieve. The plain fact was that, at least in the United States, the sanitary idea became old-fashioned long before its time. The sanitarians who loyally swore by the sanitary idea became anachronisms in the Age of Bacteriology. By the time of the First World War, almost everyone was turning his attention to microbes and microscopes as the primary aspect of the effort to bring about the City of Health.[24]

Richardson would not have recognized the City of Health which some sought to erect in the United States in the name of the new laboratory science. True, Hermann M. Biggs of New York gave the continuing public health movement a somewhat Richardsonian slogan ("Public Health is purchaseable: Within natural limitations any community can determine its own death rate."), but it was a slogan based upon antitoxins, diagnostic laboratories, and tuberculosis campaigns rather than upon the general cleansing of the environment which Richardson and Chadwick had stressed.[25] Charles V. Chapin of Providence went even further, saying that hygienically it mattered little whether a city's streets were cleaned or even whether houses were fumigated after contagious disease so long as people who carried germs were controlled. The result was that with modern care a city might have an amazing decline in mortality but yet remain superficially ever so dirty, so long as the really dangerous (human) filth were carefully removed.[26]

Richardson and Chadwick were undoubtedly naïve in thinking that with a broad, environmental sanitation they had the clue to a completely healthy world. Biggs, Chapin, and others of their generation eventually came to realize that they had been equally innocent in believing that laboratory techniques, antitoxins, and rigid isolation facilities would provide the full answers. Dubos and others aptly point out to us today that we, too, are naïve when we allow ourselves to think that our vaccines, sera, and drugs will by themselves bring an end to disease. There is, nevertheless, no slackening off of sanitary idealism today. This is true even in the face of informed evidence that an uncritical

[24] See James H. Cassedy, "Dr. Charles V. Chapin and the modern public health movement," (Ph.D. thesis, Brown University, 1959), chapters VI and VIII, *passim*.
[25] C.-E. A. Winslow, *The life of Hermann M. Biggs*, Philadelphia, 1929.
[26] Cassedy, *op. cit.*, chapters XII and XVIII, *passim*.

preventive and curative idealism is creating problems of demography and eugenics faster than it is making mankind healthier.[27] Our modern approach to Hygeia increasingly, and of necessity, combines what is valid of the sanitary idea with the many contributions of the Age of Bacteriology and Virology. Perhaps there is for us today no more valid element in the idealism of the English reformers than their insistence upon thorough planning and a total coordinated community effort for health. The case for a real social medicine is very likely no less today than it was a hundred years ago.

27 René J. Dubos, "Medical utopias," *Daedalus,* Summer 1959, 410-424. The grounds for present-day idealism are found readily in scientific progress of the sort which leads an eminent man like Sir Macfarlane Burnet to write recently that ". . . without important exception man can now control all the infectious diseases that seriously threaten human life." Burnet, "The mechanism of immunity," *Sci. Amer.,* 1961, *204,* 58.

The Problem of the Discovery of the Pulmonary Circulation

L. G. WILSON*

THE question of who first discovered the pulmonary circulation has been much disputed. In this controversy, great stress has been laid upon possibilities for plagiarism, or means of communication, and currents of influence.[1] People tend to forget that at some time some man, by the independent reasoning of his own mind, must have concluded that the blood all circulated through the lungs in order to get from the right side of the heart to the left. The proper question then is what observations of anatomy and physiology did he make which would lead him to such a conclusion—and which would permit other men to confirm or reject his theory. The actual observational basis for the theory of the pulmonary circulation is not obscure, but in the controversy over priority it has often been overlooked.

Three different men discovered the pulmonary circuit of the blood: an Arab of the thirteenth century—Ibn an-Nafis, a Spaniard —Michael Servetus, and an Italian—Realdus Columbus, both of the sixteenth century. Their discoveries were almost certainly independent in each case, but all three seem to have begun their reasoning from the same literary source, namely, that passage at the end of the tenth chapter of the sixth book of Galen's *De usu partium*, where Galen shows that blood which has passed into the pulmonary artery from the right ventricle of the heart must pass through the anastomoses between arteries and veins into the pulmonary vein when the lungs collapse in expiration. Galen says:

> All over the body the arteries and veins communicate with one another by common openings and exchange blood and *pneuma* through certain invisible and extremely narrow passages. But if the large orifice of the arterial vein [pulmonary artery] always lay uniformly open and if Nature had not found some device which could close and open it again at the proper times, the blood would never be taken over into the arteries through the little, invisible orifices when the thorax contracts. For attraction and expulsion are not naturally the same for every material and every place; on

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1 For a recent and excellent discussion of research along these lines see Edward D. Coppola, "The discovery of the pulmonary circulation: A new approach," *Bull. Hist. Med.*, 1957, *31*, 44-77.

the contrary, just as a light substance is attracted more easily by expanding instruments than a heavier one and also expelled more easily when they contract, so also attraction and expulsion too are accomplished through a broad passage more readily than through a narrow one. When the thorax contracts, the venous arteries [pulmonary veins], pushed inward and compressed from all sides, instantly force out the *pneuma* they contain and receive in exchange a portion of blood through those fine openings, an exchange that would never take place if the blood were able to run back through a very large opening, such as that of the vein [pulmonary artery] into the heart. As it is, however, when the blood is compressed and cut off from returning through the large orifice, some of it trickles through those fine openings, into the arteries. Perhaps it is already clear to you what an excellent thing this is for the lung, if you remember what I have said about its nourishment.[2]

Thus Galen has shown that the blood which has passed into the pulmonary artery from the right ventricle of the heart must pass through the anastomoses between arteries and veins into the pulmonary vein, when the lungs collapse in expiration. The reason for this is that the semilunar valves at the openings from the right ventricle into the pulmonary artery prevent the return of the blood from the artery back into the right ventricle. It is fairly clear from this, and earlier passages in this chapter, that Galen considered this mechanism to serve principally for the nourishment of the lung. He says that the heart supplies the lung with blood for nourishment. However, without the membranes at the mouth of the pulmonary artery the blood would flow into the lungs when they expanded with the chest in inspiration, but would retreat again into the heart when the lungs were compressed in expiration. With each expiration of air the lungs would, therefore, be deprived of nutrition. Such irregular nutrition would hinder the lungs in their function of providing air for the left side of the heart.[3] Thus, although, in the passage quoted, Galen mentions all of the elements of the pulmonary pathway and the mechanism by which the blood might pass at least part way along it, his own interpretation of the pulmonary pathway is that it is purely nutritional. In his system of physiology Galen had to provide for the passage of blood from the right ventricle to the left, but he did this by means of his postulated pores in the interventricular septum. Yet, if the existence of these pores be

2 Galen, *De usu partium*, Bk. VI, Ch. X; Kühn III, 455-457. This translation has been given me by Mrs. Margaret T. May, Department of Zoology, Cornell University. Mrs. May has in preparation an English translation of the whole of Galen's *De usu partium* and has very kindly allowed me to quote the above passage in advance of the publication of her own work.

3 Leonard G. Wilson, "Erasistratus, Galen and the pneuma," *Bull. Hist. Med.*, 1959, *33*, 293-314, esp. p. 302.

once questioned, then the way is open for a re-interpretation of the function of the pulmonary pathway which Galen has described.

While we may not be sure that the three discoverers of the pulmonary circuit—Ibn an-Nafis, Servetus, and Columbus—each started from this particular passage in Galen, yet all three make reference to Galen; indeed, Servetus refers explicitly to Books VI and VII of the *De usu partium*,[4] and all three had access to most of the works of Galen, including the *De usu partium*. Ibn an-Nafis had available in the Arabic language the translation of Galen's works made by Hunain Ibn Ishaq in the ninth century.[5] In the sixteenth century, fairly complete editions of Galen's works, embodying fresh translations made directly from the Greek into Latin by contemporary humanist scholars, had become available.[6]

The factor in common between these three discoverers of the pulmonary circulation was, I think, that they had been able to read Galen's writings extensively, they had been able to check his assertions by their own dissections, and they were able to acquire such familiarity with his work as to wonder whether his conclusions were invariably correct and whether a slightly different interpretation might be true. For the idea of the pulmonary circuit is only slightly different from what Galen said—although far different in its theoretical implications.

The close relationship of the discoverers of the pulmonary circulation to Galen is supported by a detailed examination of their writings. Ibn an-Nafis, after recording and commenting upon the sayings of Avicenna, states:

> As the production of the [vital] spirit is one of the functions of the heart, and as this spirit consists of much refined blood with a large admixture of airy substance, it is necessary that the heart should contain both refined blood and air so that the spirit may be generated out of the substance produced by their mixture; this takes place where the spirit is generated viz. in the left cavity of the heart. It is, moreover, indispensable for the heart of man and of such animals as have lungs like him, to possess another cavity in which the blood is refined in order to become apt for the mixture with the air; for if air is mixed with thick blood, it is not possible to form a homogeneous substance out of them. This cavity is the right cavity of the heart. The blood, after it has been refined in this cavity, must be transmitted to the left cavity where the [vital] spirit is generated. *But there is no passage between these two cavities; for the substance of the heart is solid in this*

[4] Charles D. O'Malley, *Michael Servetus, a translation of his geographical, medical and astrological writings with introduction and notes.* Philadelphia, 1953, p. 205.

[5] See Donald Campbell, *Arabian medicine and its influence on the Middle Ages* (2 vols., London, 1926; vol. I, pp. 49-50, 61-63) for a discussion of the translations of Hunain.

[6] George Sarton. *The appreciation of ancient and mediaeval science during the Renaissance (1450-1600).* Philadelphia, 1953, pp. 17-33.

region and has neither a visible passage, as was thought by some persons, nor an invisible one which could have permitted the transmission of blood, as was alleged by Galen. The pores of the heart there are closed and its substance is thick. Therefore, the blood after having been refined, must rise in the arterious vein to the lung in order to expand in its volume and to be mixed with air so that its finest part may be clarified and may reach the venous artery in which it is transmitted to the left cavity of the heart. This, after having been mixed with the air and having attained the aptitude to generate the [vital] spirit. That part [of the blood] which is less refined is used by the lung for its nutrition.

For this reason the arterious vein has solid substance with two layers in order to make more refined that (the blood) which transsudes from it. The venous artery on the other hand has thin substance in order to facilitate the reception of the transsuded [blood] from the vein in question. And for the same reason there exists perceptible passages (or pores, *manāfidh*) between the two [blood vessels].[7]

Ibn an-Nafis here outlined a system of functions for the heart and lung very similar to that of Galen. The important exception was that he considered the septum to be no thinner than any other parts of the heart wall, which certainly do not permit the seepage of blood. Therefore, if the blood is to pass from the right side of the heart to the left, it must travel by the pulmonary pathway.

Perhaps the most striking feature of this passage is that it ascribes the same function to the thick coat of the pulmonary artery as Galen had, namely, to permit only the finer part of the blood, coming from the right ventricle of the heart, to escape from the pulmonary artery, since the lung requires finer blood for its nutrition.[8] Such a particular feature in common can hardly be a coincidence. It suggests that Ibn an-Nafis had studied Book VI of the *De usu partium*. This is not to imply that he is not original. The conviction with which he described the thickness and solidity of the interventricular septum strongly indicates that he had studied the dissected heart. Let us assume this. He studied the heart—he studied Galen. He came to a conclusion different from that of Galen concerning the septum. Thus, having closed off one of Galen's pathways for the blood to pass out of the right ventricle, he must needs send all of it along the other—through the lung.

It is probable that much the same line of reasoning, starting from the same passages in Galen, was followed by Michael Servetus (1511-1553) in arriving at the idea of the pulmonary circuit of the blood. Professor Temkin has examined the question of

[7] Max Meyerhof, "Ibn an-Nafis (XIIIth cent.) and his theory of the lesser circulation," *Isis*, 1935, *23*, 100-120. Quotation is from p. 116.

[8] Galen, *De usu partium*, Bk. VI, Ch. X; Kühn III, 451-452.

whether Servetus derived any of his knowledge or ideas from Ibn an-Nafis. He has concluded not only that there is no evidence that Servetus knew anything of the existence of Ibn an-Nafis or his work, but also that there are significant differences between the theory of Servetus and that of Ibn an-Nafis.[9] Coppola, on the other hand, suggests that it is not entirely impossible for threads of literary transmission to extend from Ibn an-Nafis to northern Italy via the traveller, scholar, and translator Andrea Alpago. Alpago lived in the Middle East for thirty years in the late fifteenth century collecting and translating Arabic medical works. He is known to have translated one of Ibn an-Nafis' works and may have translated others. Among Alpago's manuscripts there may, therefore, have been a description of the pulmonary circulation, rumour of which may have reached the ears of Columbus.[10] The evidence cited by Coppola is highly suggestive and requires further investigation, but, if proven, I suggest that such literary influences would only be effective on a mind already prepared by the study of Galen's works and its own effort to comprehend dissections. The problem of the pulmonary circuit is one which in the sixteenth century assumes importance only within the context of Galen's writings. Yet the discovery, or rather emphasis, of the pulmonary circuit was not a thing to attract timid minds nor those which court popularity. To contradict Galen was to invite the abuse of his numerous and authoritative supporters. The first instinct of a man bent on such an independent course would be to cite precedents in support of his view rather than to claim excessive originality. Therefore, if either Servetus or Columbus had known of the work of Ibn an-Nafis, he would have been glad to mention it. While Servetus describes his view of the pulmonary circuit as new and different from that of Galen, he mentions it only as incidental to his main theme, the Trinity. I do not think that Servetus ever had any idea that he would build his reputation on the discovery of the pulmonary circulation. On the contrary, he could find so few to agree with his general heretical ideas that he would have grasped with eagerness the opportunity to quote an authority in support of any part of them.

Servetus was strongly influenced by the ancient ideas of the *pneuma* or, as it is called in Latin, *spiritus*, and he used it as

[9] Owsei Temkin, "Was Servetus influenced by Ibn an-Nafis?" *Bull. Hist. Med.*, 1940, *8*, 713-735.

[10] Coppola, *op. cit.* (1), pp. 67-76.

a theological as well as a physiological concept. In the following passages, therefore, it is to be remembered that he is concerned mainly with the generation of the *spiritus* in the living body. This passage is the famous one from the *Christianismi restitutio* dealing with the pulmonary circuit of the blood:

> In this matter there must first be understood the substantial generation of the vital spirit which is composed of a very subtle blood nourished by the inspired air. The vital spirit has its origin in the left ventricle of the heart, and the lungs assist greatly in its generation. It is generated in the lungs from a mixture of inspired air with elaborated subtle blood which the right ventricle of the heart communicates to the left. However, this communication is made not through the middle wall of the heart, as is commonly believed, but by a very ingenious arrangement the subtle blood is urged forward by a long course through the lungs; it is elaborated by the lungs, becomes reddish yellow and is poured from the pulmonary artery into the pulmonary vein. Then in the pulmonary vein it is mixed with inspired air and through expiration it is cleansed of the sooty vapours. Thus finally the whole mixture, suitably prepared for the production of the vital spirit, is drawn onward from the left ventricle of the heart by diastole.

He then gives his reasons for this new and different view:

> That the communication and elaboration are accomplished in this way through the lungs we are taught by the different conjunctions and the communications of the pulmonary artery with the pulmonary vein in the lungs. *The notable size of the pulmonary artery confirms this; that is, it was not made of such sort or of such size, nor does it emit so great a force of pure blood from the heart itself into the lungs merely for their nourishment.*[11]

Servetus here speaks so confidently of the force of blood in the pulmonary artery that we may ask how he could have known such an interesting fact. Has he imagined this force of blood or has he seen it? His words "so great a force of pure blood" strongly suggest that he is speaking of something which he has seen and which has impressed him deeply. He must have opened the pulmonary artery in a living animal and have observed the blood spurt from it. But how could he have done this? It is no small matter to expose the pulmonary artery, deep as it is within the thoracic rib cage, and when exposed, the pleural membranes have usually been cut or torn so that the lungs are collapsed and the animal about to die.

In his book *On Anatomical Procedures* Galen describes a technique for opening the chest to reveal the beating heart in a living animal while leaving the pleural membranes intact so that

[11] O'Malley, *op. cit.* (4), pp. 204-205 (italics mine).

the lungs do not collapse. His method was to remove the sternum by cutting through the costal cartilages thereby giving direct access to the pericardial space.[12] He recommends this method specifically for those who wish to observe the pulmonary vessels,[13] and there seems no reason why it could not be used to observe the pulmonary artery and the flow of blood in it. We cannot of course be certain that Servetus used this method, but it is clear that he was sufficiently familiar with Galen's anatomical work to have known of it.

Servetus seems to have obtained his anatomical training at Paris. At any rate he had become sufficiently proficient in anatomy that he was able to act as anatomical assistant to Johann Guenther of Andernach (1505-1574), a humanist scholar and physician who had translated some of Galen's works from Greek into Latin and who did original work in anatomy.[14] The anatomy which Servetus learned was almost certainly the anatomy presented in Guenther's "Institutes of Anatomy" which is entirely Galenic. Of particular importance is Guenther's account of the heart and pulmonary vessels because in those respects in which it is strictly Galenic it is more accurate than the accounts found in anatomies prior to Guenther such as Mundinus and Berengarius. These writers, following Avicenna, ascribed three ventricles to the heart. The right and left ventricles were the right and left ventricles as we know them but the middle ventricle was not strictly speaking a cavity at all but rather the pores which were thought to exist in the interventricular septum.[15] Moreover, both of these writers describe the valves or *ostiola* which control the flow of blood from the auricles into the ventricles but both err in considering that the tricuspid valve allows a back flow of blood from the right ventricle into the vena cava. They were wrong not only in their understanding of the action of the valves, but in their understanding of Galen on this point, for he had considered that the tricuspid valve was tight.[16] Since Mundinus was the earlier and more in-

12 Galen, *On anatomical procedures*, translated with introduction and notes by Charles Singer. Oxford, 1956, pp. 190-192.

13 *Ibid.*, p. 191.

14 Sarton, *Appreciation of ancient and mediaeval science*, p. 17. Also: Johann Guenther of Andernach, *Institutionum anatomicarum . . . libri quatuor*, 2d. ed., Basel, 1539, preface a5.

15 [Ketham, Johannes de], *The Fasciculo di medicina Venice 1493*, with an introduction etc. by Charles Singer, in *Monumenta Medica II*, Florence, 1925, pt. 1, p. 83. Cf. Jacopo Berengario da Carpi, *A short introduction to anatomy*, translated with an introduction and notes by L. R. Lind, with anatomical notes by Paul G. Roofe. Chicago, 1959, p. 95.

16 Galen, *De usu partium*, Bk. VI, Ch. XV; Kühn III, 484.

fluential writer and since Berengarius was certainly merely following him, we may consider his account alone. He writes:

> Cut then the heart first in the right side beginning from the point, yet guarding thyself against reaching the opposite wall, but dividing at the side of the middle ventricle. Thou wilt at once come upon the right ventricle and see two orifices therein. One of these orifices openeth toward the liver and the *vena chilis* entereth thereby [right auriculo-ventricular aperture]. This is the largest orifice for through it the heart draweth blood from the liver and expelleth blood unto all the other organs. Moreover as the heart taketh in through this orifice more than it doth expel, Nature ordained that at the time of contraction of the heart, it should be shut when it hath to expel and should open again when the heart expandeth. Wherefore it hath three *ostiola* which open from without inward. By the same orifice also the expulsion of the perfectly prepared blood doth take place.[17]

Mundinus' assumption that the three *ostiola* closed incompletely so that the right ventricle alternately received and discharged blood permitted the idea that there was an ebb and flow movement from the heart into the veins.[18] He seems to have adopted such a view under the influence of his reading of Aristotle. At least that was the opinion of one of his sixteenth century commentators, Matthaeus Curtius, who criticizes him for his inaccurate interpretation of Galen.[19] According to Heseler's notes of Curtius' lecture at Bologna in 1540 Curtius said:

> And Nature has made three valves in the right ventricle of the heart so that the blood should not return from the heart to the liver, as Mundinus has maintained, in order not to return before it is digested. And this occlusion must be complete, what is against the opinion of Mundinus but in agreement with Galen.[20]

It is interesting that the revival of interest in Galen's writings which was part of the general interest in Greek literature that accompanied the humanist movement of the sixteenth century should produce a more accurate and thorough study of anatomy. For our purpose, it is important that so long as Mundinus' theory of the action of the heart persisted, there was no possibility of

17 Mundinus, *Fasciculo di medicina,* p. 83.

18 Dr. Charles Singer seems to have taken Mundinus' description of the action of the heart as an accurate reflection of Galen's, which it is not, for the concept of ebb and flow in the veins figures largely in his account of Galenic physiology. See Charles Singer, *A short history of medicine,* New York, 1928, p. 58. Such an ebb and flow from the heart, of course, becomes impossible if the tricuspid valve is a tight valve that does not permit backflow.

19 Baldasar Heseler, *Andreas Vesalius' first public anatomy at Bologna 1540. An eyewitness report together with his notes on Matthaeus Curtius' lectures on Anatomia Mundini,* edited with introduction, translation, and notes by Ruben Eriksson. Stockholm, 1959. p. 243.

20 *Ibid.*

the discovery of the pulmonary circulation because there was no theoretical need for it. The excess blood in the right ventricle of the heart could be considered simply to disgorge back into the veins.

For this reason it is significant that the anatomy which Servetus learned, which is to say the anatomy which Guenther of Andernach taught, was thoroughly Galenic and entirely opposed to Mundinus. Moreover, it was closely related to dissections and possibly to vivisections. In writing of the right auriculo-ventricular opening Guenther says: "There are however in the mouth of the vena cava three structures very similar to plough points, whence I think they call them *trisuleae,* acting as doors of outstanding thickness, strength and size opening inward. *They prevent the blood, once having entered, from retreating.*"[21]

Similarly, Guenther considers that the three semilunar or sigmoid valves in the opening of the pulmonary artery act in the same way as the three flaps of the tricuspid valve, namely, to prevent backflow of blood.[22] At the same time he considers that the pulmonary artery (or artery-like vein as he terms it) exists for the purpose of supplying elaborated blood to the lungs.[23] Since the whole of Guenther's "Institutes" is intended to be a guide to anatomy and consequently to dissection for medical students, it is not surprising that he should at times give hints drawn from his own experience as in the following passage: "But in order that you may observe the ventricles with your own eyes you must use the scalpel. The right one may be dissected with a straight line and black blood flows forth which, when the cavity has been dilated and the vessels pressed must be cleaned with a sponge."[24]

Vesalius also describes a technique by which the pulmonary artery could be observed. He had developed a method of opening the chest very widely in order to be able to observe the movements of the heart in a living animal. With the animal (a dog or pig) laid out on its back on the dissecting board, Vesalius had cut through the ribs along either side of the chest and, after separating both ribs and breast bone from the diaphragm, had lifted up the entire ventral wall of the chest and turned it forward, thereby

[21] Johann Guenther of Andernach, *Institutionum anatomicarum secundum Galeni sententiam ad candidates medicinae libri quatuor.* Basel, 1536, p. 88, translation and italics by the author.

[22] *Ibid.*

[23] *Ibid.*, p. 78.

[24] *Ibid.*, p. 88.

exposing the whole chest cavity. The immediate result was to collapse both lungs. Vesalius cautions that at this point you must first act to prevent the suffocation of the animal and describes how this may be done by means of a tracheotomy:

> In truth in order that the life of the animal may be revived in a certain manner, an opening must be made in the main stem of the windpipe in which a pipe made of reed or cane is introduced and this is inflated so that the lung is expanded and the animal itself may secure air in some way, for the lung in this living animal expands to an extent equal to the cavity of the thorax and the heart takes on its powers again, and the change alters its action for the better.
>
> Therefore when the lung has been inflated again and again thou mayest examine the movement of the heart by sight and touch as much as is desired. . . .[25]

If this vivisection could be used to examine the movement of the heart, it could also be used to study the blood in the pulmonary artery and vein. Whether this technique was original with Vesalius or not, I do not know, but he seems to be the first to describe it in print. What is significant is that Servetus like Vesalius had studied in Paris so that they shared a common background in anatomy. These two men were successively anatomical assistants to Johann Guenther who speaks of them thus:

> My first helper was Andreas Vesalius, a young man marvellously diligent in anatomy, a practitioner of pure medicine unalloyed. And after him, Michael Villanovanus [Michael Servetus] was closely associated with me in dissection. He is well versed in every branch of literature, and in Galen is second to none. To these two I both lectured on Galen and showed them what I had discovered through the examination of muscles, veins, arteries and nerves.[26]

At Paris, Servetus was also taught by Jacobus Sylvius and Jean Fernel, two famous Galenic physicians.[27] It is evident that his training both in Galenic medicine and in the practical art of dissection was very thorough. He thus possessed the skill and experience needed to perform either the Galenic vivisection of the thorax or possibly Vesalius' modification of it.

The reasons that Servetus gives for departing from the doctrines of Galen are very different from those of Ibn an-Nafis. Servetus

[25] Samuel W. Lambert, "A reading from Andreae Vesalii 'De humani corporis fabrica' Liber VII, De vivorum, sectione nonnulla caput XIX." *Charaka Club Proc.*, 1935, *8*, 4-21.

[26] Quoted by Roland H. Bainton from Johann Guenther, *Institutionum anatomicarum . . . libri quatuor*. Basel 1539, preface a5 and verso in R. H. Bainton, *Hunted heretic, the life and death of Michael Servetus*, 1511-1553. Boston, 1953, p. 107, Cf. Harvey Cushing, *A bio-bibliography of Andreas Vesalius*, New York, 1943, pp. 49-51.

[27] *Ibid.*

argues that the pulmonary artery is too large and carries too much blood into the lungs to serve only for nourishment. He says:

> Nor would the heart be of such service to the lungs, since at an earlier stage, in the embryo, the lungs, as Galen teaches, are nourished from elsewhere because those little membranes or valvules of the heart are not opened until the time of birth.[28] Therefore that the blood is poured from the heart at the very time of birth, and so copiously, is for another purpose. Likewise, not merely air, but air mixed with blood, is sent from the lungs to the heart through the pulmonary vein; therefore the mixture occurs in the lungs.
>
> In the left ventricle of the heart there is no place large enough for so great and copious a mixture, nor for that elaboration imbuing the reddish yellow colour. Finally, that middle wall, since it is lacking in vessels and mechanisms, is not suitable for that communication and elaboration, although something may possibly sweat through. By the same arrangement by which a transfusion of the blood from the portal vein to the vena cava occurs in the liver, so a transfusion of the spirit from the pulmonary artery to the pulmonary vein occurs in the lung. If anyone compares these things with those which Galen wrote in Books VI and VII, *De usu partium*, he will thoroughly understand a truth which was unknown to Galen.[29]

Servetus here points out to us the specific source in Galen's writings which was the background of his own thinking on the function of the heart and lungs. Yet this close relationship to Galen makes Servetus' argument for the pulmonary circuit of the blood, based upon the size of the pulmonary artery, especially significant, because Galen's original reason for saying that blood seeped through the interventricular septum from the right to the left ventricle of the heart was that the pulmonary artery was too small, in comparison wih the size of the vena cava, to carry away from the right ventricle all of the blood which the latter vessel brought to it.[30] Therefore, Servetus' opinion of the size and importance of the pulmonary artery is not an opinion which could have been derived from the reading of Galen and consequently must have come from his own experience of dissection.

After establishing the passage of the blood by way of the lungs, Servetus also saw that the consequence of this was that the mixture of blood with air, which Galen had supposed to occur in the left ventricle of the heart, must be transferred to the lungs. This conclusion, so immediately and correctly drawn by Servetus, indicates

[28] An error. The pulmonary artery, together with its valves, is well developed before birth, but most of its blood passes through the *ductus arteriosus* directly into the aorta, and only a small portion passes into the lungs.

[29] O'Malley, *op. cit.* (4), pp. 204-205.

[30] Galen, *On the natural faculties*, with an English translation by A. J. Brock. London, Loeb Library, 1916, pp. 321-323.

the primary significance of the discovery of the pulmonary circuit of the blood for the history of the theory of respiration.

The importance of the discovery of the pulmonary circulation to the theory of respiration is even more clearly seen in the work of the third discoverer of the pulmonary circuit, Matthaeus Realdus Columbus (1516?-1559?), for Columbus attaches to his demonstrations of the pulmonary circuit a new theory of respiration. Columbus refers to the pulmonary circulation in at least three passages in his book *De re anatomica.* In speaking of the heart he says:

> Between these ventricles there is a septum through which, almost everyone believes, a passage from the right ventricle to the left is laid open to the blood. In order that this may be done more easily it [the blood] is rendered thin in transit on account of the generation of the vital spirits. But they go out of their way by a long road. For the blood is carried through the pulmonary artery to the lung, and there it is rendered thin. Next it is carried away, together with the air, through the pulmonary vein to the left ventricle of the heart, which [fact] no one hitherto has either observed or left recorded in writing, although it may be noticed very easily by anyone.[31]

Further on he discusses the question more fully and gives the evidence on which his opinion is based:

> On this question the Anatomists (peace be unto them) write that there is little value in this function so that they carry the altered air to the lungs, which act as fans to make a kind of little wind to the heart, and they, rather than the brain as Aristotle thought, cool it; believing that they then take up smoke and I do not know what fumes . . . produced by the left ventricle. But this statement cannot be made as they wish. Indeed, who thinks for certain that there is that in the heart which is commonly found in forges? As if there existed in the heart wood fires which, while they burn, produce smoke! And hitherto the opinion of other Anatomists concerning the use of these things was of this kind. But I think the direct opposite; namely, *that the pulmonary vein has been made in order that it might carry the blood, mixed with air by the lungs, to the left ventricle of the heart . . . for if you examine not only cadavres, but also live animals you will discover this vein filled with blood in all of them,* which would not in any wise happen if it had been constructed merely on account of the air and vapours.[32]

In arriving at the idea of the pulmonary circulation Columbus is obviously thinking within a framework of Galenic ideas. He has deduced the existence of the pulmonary circuit of the blood

[31] Columbus, M. R. *De re anatomica Libri XI.* Venice, 1559, p. 177 (my translation).

[32] *Ibid.,* p. 178. (Translation and italics mine.) Further details of Columbus' anatomical observations are given by Valverde, *Anatomia del corpo humano,* Rome, 1559, *l.* 131. See Coppola, p. 63.

from the fact that the pulmonary vein is found full of blood in living animals.

This is a quite different piece of evidence from that which Servetus offered in demonstration of the same phenomenon, for he had said nothing of the presence of blood in the pulmonary vein. Ibn an-Nafis had mentioned neither phenomenon. Long ago Sir Michael Foster suggested that Columbus might have gained his knowledge of the pulmonary circulation from Servetus because Servetus had in 1546 sent to Curio in Padua a manuscript copy of his *Restitutio* and since Columbus taught in Padua in the years 1541 to 1545, and would consequently have friends and connections there, he may have seen Servetus' manuscript.[33] Foster presents four points of evidence in his indictment of Columbus. They are:

(1) the possibility that Columbus could have seen Servetus' work;
(2) the fact that Columbus, like Servetus, draws no further conclusion from the discovery of the pulmonary circulation;[34]
(3) the fact that "Columbus almost exactly repeats Servetus' words";[35]
(4) evidence that Columbus' character was such that he would have stolen anything he could, and that Columbus did in fact claim the discovery of the *stapes* of the ear which had previously been discovered by Giovanni Filippo Ingrassia of Palermo in 1548.[36]

Points one and four of this argument must, for the lack of better evidence, be admitted as stated by Foster. They create the possibility that Columbus might have learned of Servetus' views and the probability that, if he had so learned, he would have used the information without acknowledgment. Points two and three are, however, much more doubtful. Since the Galenic system of physiology, within the terms of which both Servetus and Columbus were working, required a transfer of blood from the right to the left ventricle of the heart, the re-routing of this transfer by way of the pulmonary artery, lungs, and pulmonary vein, instead of directly across the interventricular septum, made no fundamental difference in the system as a whole. So long as the discussion was restricted to the functions of the heart and lungs, the veins and arteries throughout the body might be allowed to continue to function in the somewhat confused way described by Galen. Thus the fact that Columbus draws no general systemic conclusions

33 *Sir* Michael Foster, *Lectures on the history of physiology*. Cambridge, 1901, p. 30.
34 *Ibid.*
35 *Ibid.*, p .31.
36 *Ibid.*

from the discovery of the pulmonary circuit may be simply the result of his being a Galenist. It is not necessary, for this reason alone, to suppose that he had copied Servetus. What he had in common with Servetus was the Galenic background.

With regard to point three, whatever similarity there may be in the wording of Servetus and Columbus, there is, as we have seen, a fundamental dissimilarity in the evidence which they offer for the pulmonary circuit—the one reasoning from observations on the pulmonary artery, the other, from the pulmonary vein. It might of course be argued that Columbus, having learned of the pulmonary circuit from Servetus' manuscript, decided to cover his tracks by offering an alternative piece of evidence. But such an explanation is much more elaborate than the facts require.

However, in the case of Columbus we are faced with the same question that faced us with Servetus. How, in fact, did Columbus know that blood was always to be found in the pulmonary vein of living animals? The pulmonary veins lie more dorsally and are more difficult to observe than the pulmonary artery. He could probably have made this observation only by opening the chest very widely in the living animal and by taking steps to inflate the lungs. In other words, he must have repeated Vesalius' vivisection experiment. Fortunately, we know that he did exactly this. Columbus describes vivisectional experiments which he had performed and in which he opened the chest cavity to observe the heart and lungs.[37] These vivisections are so similar to those described by Vesalius that it seems likely Columbus had learned them from him—perhaps had seen Vesalius perform them at Padua. If we are looking for a common denominator between Servetus and Columbus, we may find it more satisfactorily, I think, in the fact that they shared a common anatomical tradition stemming from Johann Guenther of Andernach. Both had the opportunity to learn something of techniques of vivisection.

From his reasoning that the blood from the right side of the heart went around through the lungs in order to reach the left ventricle, Columbus drew the same conclusion as Servetus, namely, that an admixture of air with the blood occurs in the lungs, and that from this mixture are generated the vital spirits. He says:

> But these three vessels [the trachea, pulmonary artery, and vein] are fabricated from a rare, porous and light substance, and from them arises the lung whose function is . . . the cooling of the heart, which it does

[37] Columbus, *De re anatomica*, p. 257.

by carrying cool air to it. In addition the lung was made for inspiration, expiration and in order that it might subserve the voice. . . . In addition to these [functions] I am going to add another, of the greatest importance. . . . It is, in fact, the preparation and almost the generation of the vital spirits which according to the current fashion are perfected more in the heart. . . . For [the air] is carried by means of the trachea through the whole lung, but the lung mixed that air together with that blood which is carried from the right ventricle of the heart through the pulmonary artery. For this pulmonary artery, in addition to the fact that it carries blood for its nutrition, is so broad that it could carry it for the sake of another purpose as well. Blood of this kind is agitated on account of the unceasing movement of the lungs, it is rendered thin and it is mixed together with the air, and in this collision and breaking up it is prepared so that mixed blood and air are taken up at the same time through the pulmonary vein and finally are carried through its trunk to the left ventricle of the heart.[38]

It must be admitted that in this passage Columbus mentions the size of the pulmonary artery as a reason for supposing that it does more than nourish the lung, but he does not lay particular stress upon it nor does he mention the force of the flow of blood in it.

To sum up the arguments by which the three different discoverers of the pulmonary circulation were brought to their conclusions we find that the arguments were different in each case.

1. Ibn an-Nafis argued that the interventricular septum was as thick and dense as the rest of the heart wall which certainly does not ooze blood. Therefore, the blood must go around by the lungs.

2. Servetus would admit the possibility that there might be pores in the septum by which a little blood might sweat through, but he thought that the pulmonary artery was too large and carried too great a force of blood to serve merely for the nutrition of the lungs. His statements are so phrased as to make it difficult to understand how they would have been suggested to him unless he had actually opened the pulmonary artery in a live animal during a vivisection experiment.

3. Finally, Columbus based his ideas on the fact that the pulmonary vein contains blood instead of air, as, according to Galenic theory, it should. Moreover, Columbus says plainly that his ideas are based on what he has seen in vivisection experiments and can be checked by further such experiments.

All three men wrote and thought and experimented within the framework of the Galenic system of physiology. Probably, when they considered the function of the heart and lungs, all three were

[38] Columbus, *op. cit.*, p. 223 (translation mine).

influenced by Galen's discussion in Book VI, Chapter 10, of the *De usu partium* where he describes the irreversible passage of the blood from the right ventricle of the heart into the pulmonary artery and through the lungs. In order to make the observations on which alone their theoretical statements were based, both Servetus and Columbus had to employ techniques of vivisection. Servetus probably used the technique of opening the pericardial cavity by removal of the sternum, taking care not to injure the pleural membranes described by Galen.

Columbus probably used Vesalius' vivisectional technique for opening the thorax. On the present evidence the increased attention paid to Galen's writings in the sixteenth century as a result of the humanist movement and the consequent renewed activity in both dissection and vivisection seem to have led to the discovery of the pulmonary circuit of the blood.

Isaac Israeli's Fifty Admonitions to the Physicians†

ARIEL BAR-SELA* and HEBBEL E. HOFF*

Introduction

Last summer, while reading in the Universitätsbibliothek of Tubingen, we chanced upon a work of unique character bound between Maimonides' treatises on Asthma and Coitus in Ms. Orient. 4°836 of that library. This work, entitled "Ṣefer Muṣar Harofi'm"—The Book of Admonitions to the Physicians—and attributed by the scribe to "Isaac Israeli of blessed memory," struck us as being of unusual interest and quite different from most ancient works on medicine in that it is not a text of medicine but rather a compilation of personal advice and counsel to the physician. In particular, we were moved by the unusual mixture of idealism and practicality which makes this work strikingly applicable to our own time. We thought it therefore desirable to render it into English in order to make available this interesting work to the English-speaking physicians and medical historians of today.

Isaac son of Solomon, known in the West as Isaac Israeli or Isaac Judeus, was born in Egypt in the first half of the ninth century; neither the date of his birth nor that of his death are known with certainty, but they are generally taken to be 840 and 950 respectively. He started his medical career as an oculist in Cairo, then migrated west to Qayrawan (Tunisia), where he first served Zyadat Allah, the last of the Aghlabite rulers of Tunisia, and later the conquering Fatimid Imam of Egypt at whose behest he wrote most of his medical compositions.

In the introduction to the English translation of Roger Bacon's *The Cure of Old Age and the Preservation of Youth,* published in London in 1683 by Richard Brown, the translator counts Isaac among the foremost Arabic physicians and states: "Isaac Beimiram, the son of Solomon the Physician. He flourished about the Year of Christ 1070. After Johannes Serapio's time. He writ much in Physick, as of Fevers, of Urine, of Diet, of the Stomach, beside several Tracts in Philosophy." Though inaccurate, this brief de-

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scription reflects the measure of prominence attained by Isaac Israeli.

Since most of the available information about Isaac is drawn from the biographical dictionary of Arabic physicians of ibn abi Usaybia,[5] we have included a translation of the entire biographical sketch of Isaac contained in that work.

(I'ṣḥaq bin Sulyman) al I'sraili was an eminent physician; eloquent, learned, famous in skill and knowledge, a good author, of excelling mind, and he was surnamed abu Y'aqub. He is the one whose renown has spread and whose knowledge has become known by 'al I'sraili'. He was of the people of Egypt; he first practised as an oculist, then he settled in al Qayrawan and was a follower of I'ṣḥaq bin 'Amran who taught him. He attended the Imam abu Muḥammad 'Ubaid Allah al Mahdi, ruler of Africa, in the art of medicine.

Just as I'ṣḥaq ibn Sulyman was excellent in the art of medicine, so was he a keen master of eloquence, and dextrous in the disputations of the sciences. He lived a long life, dying at over a hundred years, and he had not taken wives, nor begotten a son.

It was said to him: "Would you not be more fortunate if you would have had a child?" And he said: "Since I have the Book on Fevers—No!" meaning that the propagation of his memory by the Book on Fevers is more enduring than its propagation by a child. It is related that he said: "I have four books that will perpetuate my memory more than a son, and they are the Book on Fevers, the Book on the Nutrients and on the Drugs, the Book on Urine, and the Book on the Elements." He died about the year twenty and three hundreds [i.e., 932 A.D.].

A'ḥmad bin I'brahim bin abu Khalid, known as ibn al Jazar, said in the Book of the Histories of the Kingdom, that is, at the commencement of the reign of the Imam abu Muḥammad 'Ubaid Allah al Mahdi who appeared from the West: "I was told by the practitioner I'ṣḥaq bin Sulyman who said: 'When I came from Egypt to Zyadat Allah bin al Aghlab, I found him dwelling with the troops in al A'rbas. I rode over to him, and when he was informed of my approach, for he had already asked for me, he dispatched to me five hundred dinars, which encouraged me on the journey. I was summoned before him on the hour of my arrival, and I salaamed in obedience and performed the obeisance, as is required to be made to kings. And I saw his council, void of veneration, with an overpowering desire for amusement, and as the laughter rose, I was first addressed by bin Ḥunbash, known as al Yawnani, who said to me: 'Would you say that the salty would exhilarate?'

"I said: 'Yes.'

"Said he: 'And would you say that the sweet would exhilarate?'

"I said: 'Yes.'

"He said to me: 'Lo, the sweet is the salty, and the salty is the sweet?!'

"I said that the sweet would exhilarate by its lightness and pleasantness, and the salty would exhilarate by its harshness, and he persevered in his obstinacy, as he was fond of sophistry.

"As I saw this, I said to him: 'Would you say you are alive?'

"He said: 'Yes.'

"Said I: 'And is the dog alive?'

"He said: 'Yes.'

"I said: 'Lo, you are the dog and the dog is you?!'

"And Zyadat Allah laughed with intense laughter, and I realized that his zest for a jest was greater than his desire for decorum.

"Said I'ṣḥaq: 'When abu 'Ubaid Allah, called al Mahdi, came to Riqadah (?), he drew me near and advanced my rank. He had a stone in the kidney and I was treating him with remedies, among which were the cauterizing tongs. I sat on a certain day with a group from the Privy Council and they asked me about various forms of infirmities, and whatever I explained to them, they could not understand my words. I said to them: 'Lo, you are cattle, and there is nothing human in you except the name.' The story reached abu 'Ubaid Allah, and when I visited him he said to me: 'You confront our brethren, The Believers, of the Privy Council as is not allowed. By Allah the Compassionate, if you were not excused by being ignorant of their rights, regarding what is theirs from the knowledge of truth, the men of the Law would have beheaded you.

"Said I'ṣḥaq to me: 'And there I saw a man who would pursue decorum in whatever came his way, and a jest has no market with him.' "

The books (of I'ṣḥaq bin Sulyman) are: The Book of Fevers, five treatises, and there cannot be found on this subject a better book; I quote from the writings of abu al Ḥasan 'Ali bin Riḍwan his statement about it: "Say I, 'Ali bin Riḍwan the physician, that this useful book was compiled by an excellent man, and I have applied much of what is in it and I found it unsurpassed; from Allah is guidance and aid"; the Book of Simple Drugs and Nutrients; the Book of Urine; the Extracts of his Book on Urine; the Book of the Elements; the Book of Definitions and Forms; the Book of the Garden of Philosophy and in it questions on Theology; the Book of the Introduction to Logic; the Book of the Introduction to the Art of Medicine; a Book on Pulsation; a Book on Theriac; a Book on Philosophy; these are eleven dissertations.

A contemporary of Rhazes and Haly Abbas, Isaac Israeli was the first truly great physician of the Western part of the great Arab Empire. The tribute of Meyerhof,[8] who called Isaac "the greatest Jewish medical man in the Middle Ages," is only slightly exaggerated. His popularity and influence are attested to by the numerous old copies of his major compositions found in European libraries today. His works were translated into Hebrew and Latin and were widely used by medieval physicians. According to Sarton,[10] Isaac's treatise on urine in its various translations, summaries, and elaborations constituted the basis of European urological practice throughout the Middle Ages. Just as Isaac himself had predicted, his books on fevers, urine, drugs, and nutrients propagated his name for generations after his death.

Of the six medical works listed above, Friedenwald[2] and Steinschneider[11] report that only three are still to be found in European libraries, namely, the treatises on Simple Drugs and Nutrients, Urine, and Fevers. The subject of the present work exists only in Hebrew and only in one manuscript—Cod. Orient. 4°836 (fol. 93r-95v)—at the Universitätsbibliothek, Tubingen. Ibn abi Usaybia does not list it under its present title, but it could have been a part of the Introduction to Medicine mentioned above. According to Berliner,[1] it was first discovered by Moise Soave of Venice who published an Italian translation in the *Giornale Veneto di Scienze Mediche* in 1861. Kaufmann[7] considered it premature to attribute this work to Isaac Israeli; he believed it to be an original Hebrew composition of a much later date and not a translation from the Arabic as suggested by Steinschneider.[11]

A similar opinion was advanced by Guttmann[4] who posited several objections to the attribution of this work to Isaac Israeli. Of these objections, two appear to us to have validity, namely, that the statement made in Chapter 35 that "the urine informs only on matters in the liver and urinary pathways" contradicts Isaac's views expressed in his famous treatise on the Urine, and that the abundance of Biblical and Talmudic phrases in this work suggests a Hebraic origin rather than an Arabic one. Guttmann's claim that it is unlikely that a work of so famous an author would be forgotten is unacceptable in view of the fact that of the eleven works of Isaac listed by ibn abi Usaybia only a few have survived. Nor can we accept Guttmann's claim that this work is too witty to be ascribed to Isaac in view of the anecdotes related about Isaac's wit by Ibn Abi Usaybia.

In the absence of other manuscripts of the same work, and because this work is not mentioned by ibn abi Usaybia, it is difficult to establish its authenticity. It appears to us, however, that the vocabulary and the syntax strongly suggest that this is indeed a translation from the Arabic, and the Biblical and Talmudic phrases might well have been a translator's substitution for similar Arabic idioms, if not the phrases of the author himself. It is significant that the term for "enema" employed in the text (Chap. 48) is the Arabic *al ḥuqna* and not the term *clyster* which was commonly used by European Jewish writers of the Middle Ages. Furthermore, the disputations mentioned in the same chapter were considered vital in the era of Isaac and there-

after but not in Europe of the late Middle Ages. These considerations suggest a much earlier origin than the dates proposed by Guttmann and Berliner.

Another striking feature is the absence of references to any well-known authories other than Hippocrates and Galen. This, too, strongly suggests the era of Isaac which was at the beginning of the rise of Arabic medicine and before the emergence of the great masters who were so abundantly quoted in mediaeval Europe.

At the end of this work there appears an obscure Hebrew phrase—written in *a'btsr*. Kaufmann considers the possibility that this is a date—"in the month of Ab in the year 290"—and concludes that this is inadmissible since the year 290 (1530 A.D.), is later than the date of the writing of this particular manuscript, let alone the composition of the work itself. If, however, we assume this date to be 290 of the Hijrah (903 A.D.), then the year falls well within the life span of Isaac Israeli and could perhaps be the year in which this work was composed.

In our enthusiasm, and owing perhaps to differences in titles, we overlooked the fact that an English translation of this work was made in 1944 by Jarcho[6] from the edited Hebrew text[12] which was published in 1884 by Kaufmann together with a German translation.[7] Although some excerpts of this work have been published earlier by Friedenwald[2,3] and Morrison,[9] it is to Jarcho that the credit is due for first offering the entire work in English. However, since our translation was independently prepared, and since it is based upon the original manuscript and accompanied by the translation of ibn abi Usaybia's biographical sketch of the author, we believe it nonetheless advisable to offer our version for publication.

In preparing the translation from the Hebrew, we have attempted to adhere to the text as closely as possible—often at the expense of linguistic fluency—in order to provide the reader with the author's own words rather than our interpretation. References to the edited Hebrew text[12] and to Kaufmann's translation[7] have been added only where differences were substantial.

We are indebted to the Universitätsbibliothek of Tubingen for the microfilm copy of the manuscript, to the New York Public Library for the microfilm copy of the printed Hebrew edition of the text,[12] and to the Library of Columbia University for the microfilm copies of the articles of Berliner,[1] Guttmann,[4] and Kaufmann.[7]

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Ṣefer Muṣar Harofi'm

THE BOOK OF ADMONITIONS TO THE PHYSICIANS

Therein are fifty chapters

1. It is the nature of living creatures to seek their livelihood and attend to things that sustain their existence. Even man, whose image is like the image of God, is necessarily obliged to endeavor and engage in matters which will sustain his existence, his survival, and the salvation of his soul, before engaging in the rest of the studies and affairs in which others, beside himself, participate, because a man is close unto himself.[1] And therefore, the value of the art of medicine is very great, and a man is always obliged and compelled to learn it at the commencement of his studies.

2. Whereas the knowledge of medicine is very extensive, and the days of men are too short to attain its perfection,[2] the accomplished physicians are set apart, and refined, and purged of the ignoramuses, by their constant occupation in the study of books and their meditation over them day and night, and their dedication to it apart from other men, before they are needed in their profession.

3. The quickness of action in an artisan's performance, or his slowness, or his deliberateness, is according to the importance of the object on which he acts, or its triviality and unimportance. Thus, it behooves him

[1] The expression "a man is close unto himself" is a Talmudic legal presupposition that a man, by nature, tends to do the best he can for himself (Sanhedrin 9b).

[2] Compare with the first aphorism of Hippocrates: "Life is short, the Art is long; the occasion fleeting; experience fallacious, and judgment difficult."

who bores a crystal[3] to contemplate, and attend to his labour, so that he will not ruin by his haste the beauty of that work, which is not the case when dealing with the mire of the streets. And therefore, it behooves him who is occupied with the curing of the bodies of men, who are the noblest of the lower creatures,[4] to consider, to contemplate, and to be very precise with their diseases, and to perform his actions with a thoughtful mind and with deliberation, lest he err in something he cannot correct. And therefore has the Sage[5] said, that when you see a physician hastening to answer regarding any disease you inquire upon, and boasting of his treatment, consider him a fool. And said the Lord of Physicians: "I have never administered a laxative potion to a man, that my thoughts were not disturbed, and my sleep wandered from my eyes, before I administered it, and thereafter, for four nights."[6]

4. Just as I have mentioned that it behooves not the physician to be hasty in his actions, so also it behooves him not to be lazy and very tardy since most of the diseases will not await him. Rather, he must stay between the opposites; neither rash and hasty, nor lazy and tardy. Only when acute[7] ailments develop must he be quick to form his ideas and to act because they press him.

5. If you examine the books of the ancient physicians, you will find in them subjects the understanding of which is perplexing, and others that will be difficult for you, so that it might come to your mind to deny them. You have no right to speak up and dispute them, because of the great stature of those people in the eyes of man.[8] Should you have lived in their lifetime, you would have disputed with them, and come to terms with them regarding these matters. Now you must trouble yourself, and search for various interpretations for them, or deviate from the texts until, many times, certain matters in those discourses would be resolved in your mind in a way not intended by him who composed them. Indeed[9] it is possible that the author did not speak correctly, for there is not a man who errs not.[10]

3 The text employs an obscure Biblical word—*bdolaḥ*—(Gen. 2:12, Num. 11:7) from which the similarly obscure English term *bdelium* is derived. Kaufmann renders it *pearl.*

4 This conforms to the philosophical concept of the time which divided creatures into various orders of existence and ascribed to man the highest order of the lower creatures but ranked him below such higher forms as angels. Kaufmann renders it "the noblest of all creatures of this lower world."

5 Similar statements are to be found in the aphorisms of Rhazes and Mesue Sr. who were contemporaries of Isaac: Liber Almansoris Rasis: Dubitabilis est doctor qui iudicat facile; Aphorismi Jo. Damasceni: Si interrogatur semper velociter respondeas: dubitandus est. (Ref. Stillwell R 170, Venice 1497, fol. 98a and 150a respectively).

6 The Lord of Physicians, here, is Galen (see Chap. 6). Interestingly enough, Maimonides, in his Regimen of Health, attributes an identical statement to Ibn Zuhr (Avenzoar).

7 The Ms. employs an abbreviation—*hḥdi*—which we read *haḥadim*—sharp, acute, as does Kaufmann.

8 Compare with the Rabbinical edict "It is not permissible to dispute the lion after his death" (Gitin, 83b).

9 Kaufmann reads *veu'lai;* we read the more emphatic *veu'lam.*

10 This phrase is commonly translated to read *sin* rather than *err;* see Kings I, 8:46; Ch. II, 6:36; Eccl. 7:20.

And the books in which this occurrence happens mostly are those composed and expressed without argument or proof, but as adjudged edicts, like the books of Hippocrates.

6. Best among physicians is he who is occupied with, reads, and reviews the many books of the ancient physicians, and especially the books of the Lord of Physicians, Galen, who spoke at length, strove, and always labored over the treatment of ailments.

Therefore, they are mistaken who say that you should not go to the physician but to the empiricist, because the ignoramus knows not what he tries and kills a thousand before curing one. And should he say "rely on me because I have experience," harken not unto his voice, because life is too short to attempt the recognition of a single disease or the nature of one herb. Therefore, we[11] must have recourse to what the ancients have tested in the thousands of years past, who, in the magnanimous charity of their heart and their mercy upon us, have written and rendered unto us all that they have tested.

7. Should the knowledge of the physician or his wisdom be visible and revealed in the appearance of his face and frame, most men would not have erred in recognizing them and gaining the measure of their knowledge as it really is. And indeed, most of the common people would not consider, in evaluating them, anything except the magnitude of their words and talk, their self-praise, and the magnitude of their body,[12] their belly, and their beard. And therefore it was said that the ignorant see with the eyes and the enlightened see with the heart.[13]

8. If the physician but comes from a distant land, and speaks in a foreign tongue, not understood, the multitude will think him enlightened and gather unto him and take counsel from him.

9. It is to the discredit of this art,[14] and its fault, that it is joined by ignoramuses and fools who speak in its name, and there is no one to protest though all its affairs are hidden, deep, and most difficult for the wise and the enlightened.

10. Most of the ignorant physicians may at times benefit you, because they will fail, fall silent,[15] and ask you to rectify that which they have corrupted.

11. The physician does not effect the cure, but only prepares, and clears the stones from the path for Nature to act, for it is she who acts.

12. In most of the prolonged ailments men become confused, despair of their cure and say that the physician is unable to cure them, because

[11] Kaufmann omits *we*.

[12] The Hebrew *gulmam* could be read to mean either *body* or *robe*.

[13] Compare with Samuel I, 16:7—"for the Lord sees not as man sees; man looks on the outward appearance, but the Lord looks on the heart."

[14] Surprisingly, Kaufmann reads here *adamah*—land.

[15] *fall silent*. The word is most difficult to read. We read *vyishtqu*—and they will fall silent. Kaufmann reads *vyishahatu*—destroy—but since he is in doubt, he adds a question marks and "corrects" the word to read *vyashḥitu*.

cure to them is the removal of the disease all of a sudden, and they know not that when the humors become unripened or dry, as they are in quartan fever, ripening is delayed, and then months or years in that long ailment become the measure of its days.

13. Because attainment of the goal in the art of medicine is a possibility, not a certainty, while death is decreed and inevitable, it is impossible for a good and skilled physician to suffice for all men.

14. Just as you need to read all the books composed on the art of medicine, so you will need to understand their contents in terms of the fundamentals of natural science, because medicine stems from it, and also become proficient in the rules of logic, so that you will be wise in refuting the ignoramuses who walk in the guise of physician, and frighten them from before you, and they shall fear you.

15. The need for the physician to preserve health—for he is needed in the preservation of health—is not less than the need for him to remove diseases, because it is better for man not to sicken than to sicken and recover.[16]

16. The physician should not take the healing of a patient by another physician as a proof that he is an expert in the Art unless he be examined first by the various criteria that I have mentioned,[17] because Nature is the healer in most times without a physician.

17. How very guilty is the physician who promises to remove a disease because thus he alters the status of what actually exists, a possibility, and represents it as a certainty.[18]

18. If you can nourish the sick with nutrients that are related and similar to his foods in health, you will manage him in the right manner. And you should also aim to feed him at his accustomed time; thus you will strengthen his Nature.

19. Endeavour all you can to render the concoctions and the various potions pleasant to the palate of the sick, because then they will be drawn into and benefit the members; therefore sugar and honey are added and mixed with them.

20. The more you know and understand the temperament[19] of the patient and his characteristics at the time of health, and accustom yourself to palpate his pulse and observe his urine, the easier will his cure be for you.

21. If you can perform and fulfill your task with nutrients or nourishing medicaments, do it not with drugs, because most of them are enemies and foes of Nature, and especially the purgatives among them.

16 This chapter in the Ms. is confusing, self-contradictory, and meaningless unless the negative *e'in*—is not—with which the paragraph begins is applied to the entire chapter and the repetition of the first phrase is taken as an affirmative repetition.

17 Some of these criteria are detailed in Chap. 2.

18 See Chap. 13.

19 Temperament and complexion, in their archaic connotation, denote constitution and predisposition.

22. He who consults many physicians, if all do not visit him together and consent to one agreement, endangers his life, because if the one should come alone the others might try to alter or add to what the first had ordered.

23. Endeavour always to treat with simple drugs because knowing their power is easier for you than understanding the compounded.

24. Be not contemptuous of any cure of which you hear, because at times there can be attained by simple means that which you could not effect by multiple actions and drugs.

25. Rely not in your treatment upon drugs that act as nostrums, because most of these are nonsense and deceitful follies.

26. Hasten not to treat the mild illnesses by altering the temperament[19] or by evacuation, because for most of them Nature alone will suffice, with the help of a good regimen.

27. Among the virtues of the physician are, to be satisfied in his own regimen with the good nutrients in moderate quantities, to be neither a glutton nor a drunkard, and also to be disgraced and shamed by becoming ill with a protracted illness, lest the populace ask how he who cures not himself can cure others.

28. Muzzle your mouth from prognosticating[20] or proclaiming edicts; most of your utterances should be with qualifications.

29. Allow not your mouth to transgress[21] by disparaging any physician; lo, you find no man who has not his hour.[22] Let only your actions praise you, and glory not in the disgrace of others.

30. Make an effort to visit the sick of the destitute and the poor and to cure them, for you find no righteousness greater than this.

31. Reassure the patient and declare his safety even though you may not be certain of it, for by this you will strengthen his Nature.

32. Trust not in the peddlers and the producers of compounded drugs because at times they will omit a drug,[23] due to its high cost, or use one old and weak of power and ruin your labor. Therefore, limit your treatment with the compounded drugs which they peddle.

33. There are diseases the cure of which lies only in your preventing the patient from conducting himself in the evil manner in which he does, yet they always request the physician to act, and should he not act, they consider it a defect in him.

34. (Missing)

20 Prognosticating. The word in the manuscript is *mlndba* or *mlgdba*. The former could be an erroneous spelling of *milehinabe'*—to prophesize or to prognosticate, as we have rendered it, while the latter could well be a carry-over from the Arabic *gdb*—to dispraise, to disapprove; Kaufmann reads *milehinabe'*.

21 An identical Hebrew phrase is to be found in Ecclesiastes 5:6.

22 Compare with Ethics of the Father (Avoth) 4:3—("Ben 'Azai). He used to say: 'do not be contemptuous of any man nor count anything as improbable, for you have not a man who has not his hour, nor a thing which has not its place.' "

23 Or "reduce a drug."

35. The urine informs only on matters in the liver and the urinary pathways, and this when it is considered in all its circumstances, yet most of the ignoramuses of our generation seek to prognosticate over it, without seeing the patient, and to say what ails him, whether he will die or live and other stupidities.

36. It is a good quality[24] in the physician to come early to the patient while the illness is increasing and reaching its fullness, not at the arrest and decline of the illness, because then will people rejoice in him and praise his action.

37. Flee, oh physician, from endeavoring to cure the very difficult diseases because they cannot be cured, or those who harbor them might tire from the burden, or from expending their possessions, and suspect your treatment.

38. Should the patient not submit to your discipline, and should his servants and members of his household not be diligent in following your command quickly, nor honor you as is proper, do not persevere in the treatment.

39. State your fee to the patient when the illness is mighty and strong, lest after his cure he should forget your labor over him.

40. The more you increase the fee for your labor, and make dear the price of your treatment, the more your actions will be respected in the eyes of men; only in the eyes of people for whom you labor without charge will your work be belittled.[25]

41. The physician cannot pay attention and deliberate properly while treating a patient without charge, and his feet will not lead him to his house, and the treatment will not prosper.

42. Exceed not in visiting the sick and prolong not sitting with him unless necessary in the process of treating the disease, because new faces are those that gladden.

43. Attending to numerous patients[26] is the cause of confusing the mind of the physician and deranging his actions.

44. Most ignoramuses will ask you not to advise regarding your treatment of the sick, but to tell them if the patient will live from that disease or will die. For, they say in their hearts, being wise in their own eyes, that if he is to live, he will not need the physician, and if death is to be victorious, the physician could not prevent it. The fools know not, that when he says that he is to live, it is on the condition that they treat him and manage him properly.

45. Most of the ignorant physicians persist in every disease to let blood and purge, even if its cause be the thinness and diminution of heat. And

[24] We read *midat*—quality. Kaufmann reads *ḥovat*—duty.

[25] Compare with the Talmudic statement: "A physician who treats without charge is worth nothing" (Baba qama 85a).

[26] Or 'diseases.'

they will inform those who consult them, that should these humors remain in their bodies, they would suffocate them, and they will describe to them, to frighten and scare them, that the white humor on the surface of the blood is pus, and that they are full of putridity, and they will order them bled again until they dry all their humors. May God return all their reward upon their heads, dry their strength like clay, and turn their juice into summer's drought, Selah.

46. Persevere in the treatment of princes and the noble among the people, because they will reward you from their wealth, and praise you always, and love you after their recovery. But the worthless triflers will hate you, once they are safe, remembering the price which you have taken from them, for it is as a portion of their soul.[27]

47. It is a widespread custom, and a well-known folly, that men gather and come to let their blood, even though they do not need it. Some tell others that a certain day is good for blood-letting, and that one whose blood is let on it will be safe from such and such a disease. They gather by the hundreds in the house of the blood-letter, and after he sheds their blood he will expound to them, in order to take from them another portion, that he sees in the blood that they need to repeat the blood-letting, and the fools will return to be bled as before, until he would pour of the blood[28] into all his vessels, and the full he will set aside.

48. Also there is a folly spreading among the multitudes, that they fancy themselves as physicians in some ailments. They believe that it is not proper for him who has an internal abscess to eat a thing or to partake of even the very thin nutrients, thinking that the food would obstruct the trachea and prevent cough, until they cause Nature to stumble and weaken her vigor. They also believe that there is no need to administer any drink in this disease, and some of them withhold bread from all who harbor fever.

And I have seen in this country that a physician ordered an enema given to a sick person to soften his nature,[29] and as he rose to leave with it he became weak, his heart fainted, and his soul departed. From that day on, all the people of that city refrained from administering enemas to any sick person, thinking that it slays like a sword, and they made it into a law, and the physician is not permitted to administer it there.

And there are descriptions of treatments thought to be right and true, while they are a clear fallacy, such as their thinking that the young of the cocks are cooler than their females,[30] and that vinegar, since its origin

27 This somewhat obscure phrase is translated differently in Proverbs 23:7.

28 This could be a play on words since the word 'blood' could be read to mean "his money."

29 "Nature" here is a euphemism for feces.

30 This statement can be understood only in terms of the Galenical concept of the four temperaments. A century or so after Isaac, a similar subject gave rise to the vivid and pugnacious dispute between Ibn Butlan of Baghdad and Ibn Ridwan of Cairo (Schacht, J. and Meyerhof, M. *The medico-philosophical controversy between Ibn Butlan of Baghdad and Ibn Ridwan of Cairo.* Cairo, The Egyptian University Press, 1937).

is from wine, is not proper to be mixed with the nourishments of the sick. They also believe women to be warmer than men, and that sneezing marks the crisis in disease.[31] When they see that upon walking barefoot and when they cool from the outside with the chill of the air their belly softens, due to the cold and the recoil of decaying matter into the body and the intestines, they think that all that cools is laxating, according to the intensity of the coolness, and many similar follies.

49. The skilled physician need not predetermine the time for blood-letting, purging, and his other actions, because speculation is useless and diseases are compelling.[32]

50. Much work and practice weaken the vigor of the physician and constrict his soul, because he always reflects and worries over each patient, desires his health and prays for him, as he would do for the kin who is related to him.

Finished is the Book on the Physicians' Conduct
And praised be the Lord who protects the ignorant.
(Written in a'btsr)[33]

[31] See Kings II, 4:35.

[32] Kaufmann renders this paragraph quite differently; where we read "predetermine" he reads "determine experimentally," and where we read "speculation" he reads "experiment." We do not find his rendition justified either linguistically or with respect to the meaning of this paragraph which appears to us to be both clear and meaningful.

[33] See introduction.

The Plague at Athens: A New Oar in Muddied Waters

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THE 1950's have witnessed a renewed interest in the attempt to diagnose the plague at Athens as described by Thucydides. A series of articles and a book defending or mentioning the claims of such diseases as smallpox, typhus, measles, bubonic plague, typhoid fever, and ergot poisoning have appeared in the classical and medical journals.[1] One scholar has concluded regretfully that a precise diagnosis is impossible but favors typhus as "the essential cause of the plague."[2] A good number of the symptoms described by Thucydides unfortunately fit many febrile diseases with exanthemata, so that a certain amount of selectivity or carefully placed emphasis will afford an excellent defense for the claims of a number of diagnoses. Furthermore, diseases in epidemic form are known to take on varying symptoms from one appearance to the next so that exact parallels are practically impossible.

The frequent present-day lack of knowledge of Greek and medicine and the apparent imprecision of Thucydides' description may be characterized as the Scylla and Charybdis of this historical venture. A further, more indefinite and practically insurmountable, difficulty is the possibility either of an evolutionary change within the disease so as to develop manifestations markedly different from those associated with it more than twenty centuries earlier or of the extinction of the disease. Believing that the task offers some hope of success and stimulated by the new dimension added to the search by consultation with veterinary medicine, we

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1 J. F. D. Shrewsbury, "The plague of Athens," *Bull. Hist. Med.*, 1950, *24*, 1-25. H. Keil, "The louse in Greek antiquity, with comments on the diagnosis of the Athenian plague as recorded by Thucydides," *Bull. Hist. Med.*, 1951, *25*, 305-323. D. L. Page, "Thucydides' description of the great plague at Athens," *Classical Quart.*, 1953, *n.s. 3*, 97-119. W. MacArthur, "The Athenian plague: a medical note," *Classical Quart.*, 1954, *n.s. 4*, 171-174. D. L. Page, "A lay comment on a medical note," *Ibid.*, 174. G. P. Alivizatos, *The early smallpox epidemics in Europe and the plague of Athens after Thucydides*, Athens, 1950, reviewed in *Bull. Hist. Med.*, 1956, *29*, 81-82. P. Salway and W. Dell, "Plague at Athens," *Greece and Rome*, 1955, *2d ser. 2*, 62-70. E. W. Williams, "The sickness at Athens," *Greece and Rome*, 1956-1957, *2d ser. 3-4*, 98-103. W. MacArthur, "The plague of Athens," *Bull. Hist. Med.*, 1958, *32*, 242-246. E. M. Hooker, "Buboes in Thucydides?", *J. Hellenic Studies*, 1958, *78*, 78-83. In addition to these journal articles, see also the discussions in: J. H. Finley, *Thucydides*, Cambridge, 1942, 157-161; and A. W. Gomme, *A historical commentary on Thucydides*, Oxford, 1956, vol. II, 148-153.

2 H. Keil, *op. cit.*, p. 312.

have pursued the oft-mentioned but never taken path of looking for a disease which is no longer common among northern Europeans and Americans and which fits the description given by Thucydides as well, probably, as many of those previously discussed. This search was prompted not only by the omnipresent refutations leveled at all existing diagnoses[3] but also especially by the rather off-hand comment with which Thucydides ends his description of the effects of the plague on those birds and animals which prey upon man: "Although there were many unburied bodies present, all the birds and animals which prey upon human [corpses] either did not approach or died after having eaten from them. As proof of this, the absence of birds of this sort was clear and they were not seen about any corpse or anywhere else. *But dogs offered a better perception of the result because they lived with man.*"[4] (emphasis added). This involvement of the dog with the plague practically rules out all of the current theories simply because the dog has not been incriminated sufficiently in smallpox, typhus, measles, bubonic plague, or typhoid fever.[5] This fact encouraged us to look for a highly infectious fever characterized by exanthemata and possible ravages of the extremities, genitals, and eyes to which both man and dog are susceptible. We came upon a disease which fulfills these criteria and also fits to a startling degree the vast majority of Thucydides' observations: *glanders*. A quick check through Aristotle revealed that this disease was existent in the fourth century B.C. and probably, therefore, in the fifth century.[6] A survey of the history of glanders disclosed its ability to strike widely a human population.[7] Present unfamiliarity with the disease results from the fact that the development of a successful diagnostic test enabled Northern Europe and North America practically to eradicate glanders early in the twentieth century.

3 See articles and books cited in note 1.

4 II. 50. Birds are very probably not susceptible to glanders. However, the Greek does not state that the birds of prey died of the plague. Gomme (*op. cit.*, p. 156) explains this passage thus: ". . . for, while we have only negative evidence about birds of prey, who very remarkably, kept away from the neighbourhood of Athens and none was seen devouring corpses or otherwise engaged, the dogs, being domestic animals and so unable to stay away (as the birds could), afforded opportunity for observing the results of their action—they either would not touch the dead . . . , or if they did, they died." Therefore, the immunity of birds to glanders is not critical to the diagnosis of glanders.

5 See K. T. Maddy *et al.*, *Infections and diseases of veterinary public health interest*, Berkeley, 1954, *passim;* cf. W. A. Hagan, and D. W. Bruner, *The infectious diseases of domestic animals*, 3d ed., Ithaca, 1957, p. 242.

6 Aristotle, *Historia animalium*, 605a16.

7 A serious outbreak of the disease occurred in Russia after World War I. See T. G. Hull, *Diseases transmitted from animal to man*, 4th ed., Springfield, 1955, p. 174.

Thucydides' description of the plague at Athens may be reduced roughly to the following outline: the very sudden onset of the disease was characterized by fever, redness and inflammation of the eyes, tongue, and throat, and the development of a noisome breath. Sneezing and hoarseness ensued which led to coughing and ineffectual retching. Small, red, livid phlyctena and ulcers broke out over the body. Sleeplessness prevented rest, but the body did not succumb immediately to the ravages of the disease since it still had some strength on the seventh or ninth day, when death usually occurred. Those afflicted experienced extreme despair and evidently delirium, since they rolled in the streets and threw themselves into the cisterns and wells in an attempt (according to Thucydides) to satiate an unending thirst. If death was delayed beyond this period, the disease descended into the bowels and produced severe internal ulceration and excessive diarrhoea which usually terminated in death through weakness. The extremities of the body, the genitals, and the eyes may have been lost (or the use of them may have been lost) due to the ravages of the disease. Some recovered, although evidently suffering from temporary amnesia.

The parallels of this plague with glanders in man are striking. After an incubation period of from a few hours to three weeks, on the average of four days, glanders manifests itself in a general malaise, anorexia, chills, and fever up to 104 degrees Fahrenheit. The oral cavity, larynx, and conjunctiva are usually afflicted with severe inflammation or ulceration followed by coughing, hoarseness, disturbance of respiration and deglutition, and fetid breath.[8] Nausea, vomiting, and headache ensue.[9] Skin ulcers with irregular edges and sloughing, yellow-grayish bases develop over the lymphatics and spread rapidly, discharging a red to gray pus.[10] In acute cases ulceration is severe and accompanied by grave diarrhoea.[11] Wakefulness, troubled dreams, nocturnal delirium, stupor, and coma are common.[12] Death may occur any time from several days to several weeks,[13] while the degree of prostration is "entirely out of proportion to the clinical signs."[14] If death does

8 Franz Friedberger and Eugen Frohner, *Veterinary pathology*, M. H. Hayes, Trans., 6th ed., London, 1908, p. 469.

9 R. L. Cecil, *A textbook of medicine*, 6th ed., Philadelphia, 1943, p. 245; Hull (n. 7), p. 175.

10 Cecil (n. 9), p. 245.

11 G. C. Andrews, *Diseases of the skin*, 2d ed., Philadelphia, 1940, p. 411.

12 James Law, *Textbook of veterinary medicine*, 2d ed., Ithaca, 1906, vol. IV, p. 288.

13 M. W. Henning, *Animal diseases in South Africa*, South Africa, 1956, p. 174; Law, p. 285.

14 Cecil (n. 9), p. 246.

not come early, the final stage of the disease is "diarrhoea, emaciation, and fatal collapse."[15] Law's description of acute cases indicates not only the above symptoms, but also the possibility of gangrenous-like attacks on parts of the body and impairment of the use of the extremities[16]: ". . . the nose may be completely destroyed and deep facial ulcers may be formed in a week. . . There may be various complications as deposits in the lungs with pain in the chest, weak cough, aphonia, bloody expectoration and offensive breath; or the morbid process may take place in the liver or spleen with pain in the hypochondrium[17] and much prostration and even icterus; or the *muscles, bones, joints or testicles may suffer* (emphasis added) and the symptoms may suggest typhoid fever, pyaemia, osteomyelitis, or acute miliary tuberculosis."

The situation at Athens in the summer of 430 B.C. was most amenable to a plague of glanders. This disease of the ass, mule, and horse is communicable to man through direct contact with the nasal discharge of the infected animal or through a medium such as water in which the bacteria of glanders remain viable for some time.[18] Once contracted, man may communicate the disease to man by the same process of direct contact with nasal discharge or by means of infected water.[19] The sneezing and coughing which accompany the disease easily foster its rapid transmission to those in close contact with the afflicted.[20] Also, the extreme thirst and delirium, probably the result of high fever, which drove the sufferers to and into the wells and cisterns would greatly increase the range of the disease even to those who attempted to avoid direct contact with it. Horses, mules, and asses were undoubtedly present within the walls of Athens and the Piraeus. Indeed, in addition to the cavalry stationed within or very near the city, the country people must be expected to have brought a few of their work animals into the city to prevent them from falling into Spartan hands. The initial, more rapid, spread of the disease in the Piraeus

15 Hull (n. 7), p. 175.

16 Law (n. 12), p. 285. On page 289 he states: "Another characteristic of glanders in man is the frequent implication of the bone marrow and the formation of lymphoid deposits in the cancellated tissue until the bone may be reduced to a mere friable shell." This would result certainly in the loss of the use of the limbs, if not the actual physical loss of them. See also Osler, William, *The principles and practice of medicine*, New York, London, 1909, pp. 261-262, where he discusses the infectious character of the disease and indicates that 'tumours' are especially likely to appear in the extremities.

17 *Es ten kardian*, (Thucydides, II.49) may also be translated as "into the stomach."

18 Miller, *et al.* in their experimental work proved that the organism can remain viable for at least four weeks when suspended in tap water. Hull (n. 7), p. 160.

19 "Several cases have been reported in laboratory workers; indeed, probably no organism with the exception of Bacterium tularense is so dangerous to work with as glanders." Cecil (n. 9), p. 246.

20 Hull (n. 7), p. 160.

has led many to suppose that the plague was brought in by sea. In further support of this conclusion, it is pointed out that Thucydides lists Ethiopia, Egypt, and Libya as the places of origin for the plague. It should be stressed, however, that Thucydides carefully labels this view as hearsay by the cautious addition of *hos legetai*—"it is said"—and specifically leaves all questions of origin to other writers. This same caution restricts the report that the plague had broken out previously at Lemnos. Such a violent epidemic merely may have recalled previous disasters in other areas of the Mediterranean, and such association may have developed to the point of causation.[21] The early severity of the disease in the Piraeus may also be accounted for by the absence of fresh, running water in the port town, a situation easily conducive to the epidemic nature of the illness through contamination of the only *and* stagnant water supply. In fact, the Athenians first thought that the disaster was the result of poison placed in the cisterns by the Spartans. Ancient evidence for the subsequent date of the introduction of fresh, running water into the Piraeus is lacking, and archaelogical evidence is slight. Gomme believes that aqueducts and fountains may have been constructed in the Piraeus soon after the plague "because the existing wells were fouled and to avoid other disasters in the future."[22]

Thucydides' failure to associate the plague with a disease in the equine family may be explained by the fact that it would take, under the conditions prevalent in Athens, only a few cases of acute glanders among the horses to cause an epidemic among men. The nasal discharge of an infected equine would have been easily transferred from a watering container to the cistern itself. Given the highly infectious nature of this bacillus (see note 19), an epidemic could start among the crowded population of the port city through the contamination of their water supply. Even more important, the transmission of this disease to man was not suspected; indeed, such transmission was not scientifically recognized until the nineteenth century.

It should be further noted that this diagnosis accommodates the spread of the disease to Pericles' naval expedition to the Peloponnese and to Hagnon's and Cleopompos' expedition against Potideia. Thucydides specifically indicates that cavalry were included and that for the first time horse transports were made from old ships. Hence, the possible presence of glandered horses would

21 Strabo, XVII.3.10, quotes Poseidonius on why plagues break out in Egypt.
22 Gomme (n. 1), p. 148.

increase the probability of the continuation of the disease wherever the Athenian cavalry ventured.

Thucydides reports that some recovered from the disease (himself included) in spite of the general ineffectiveness of therapy. This is characteristic of glanders also. It does not respond uniformly to therapy but some recover from it apparently spontaneously.[23] Temporary amnesia may have been the result of having suffered a disease with such severe manifestations and high fever. The attainment of a supposed immunity from the disease after an initial recovery is more difficult to explain. However, short-term resistance is possible and may have induced Thucydides' more sweeping statement that complete immunity was conferred upon those who recovered. Also, an apparent recovery may still leave the victim suffering from chronic glanders which may manifest itself in recurrent milder attacks with far less severe symptoms over a period of many years before death finally results. In such cases, any association with the original plague would probably have been overlooked. Thucydides allows for such a possibility when he states that those who recovered "held something of an idle hope that for all time they would not be destroyed by any disease."[24]

It is not pretended that this diagnosis ends the controversy over the plague of Athens. Quite possibly such a happy conclusion is never to be attained because of the great number of years which separate us from the Athens of Thucydides. In spite of the immense respect which Thucydides justly commands as an historian and observer, the contemporary state of medical knowledge practically precluded him from compiling a clinical description of the plague which would satisfy the twentieth century demands of epidemiology, etiology, pathology, etc. It is maintained, however that previous assertions as to the nature of this plague will have to be re-examined in the light of the fact that the dog and many other common predators upon man are rarely, if ever, susceptible to any of the infectious diseases which are currently being offered in diagnosis of Thucydides' plague at Athens.[25]

[23] Hull (n. 7), p. 176; Cecil (n. 9), pp. 246-247.

[24] II.51.

[25] Whereas all carnivora are liable to contract glanders by consuming infected flesh. Law (n. 12), p. 284.

Midwifery and Witchcraft*

THOMAS R. FORBES**

THE profession of midwife was in general a lowly one during the fifteenth, sixteenth, and part of the seventeenth centuries.[36] It is true that women like Louise Bourgeois and Justine Siegemundin made brave efforts to raise the standard of obstetrical practice. But of what use were the sensible admonitions of Bourgeois' *Observations diverses* to a midwife who could neither afford nor read the volume?[13] She seems, particularly in rural areas, in most cases to have been the victim of ignorance, superstition, and degrading tradition, and it is no wonder that she sometimes fell in evil ways.

Medicine as practised was often at a low level; the position of midwifery was even worse, since for lack of teachers there was usually little formal instruction.[3,29] Sometimes a village woman was chosen to be a midwife chiefly because she herself had borne several children. The dubious skill which she brought to the delivery was a blend of hearsay, empiricism, and superstition. Medicines, often nasty, were usually of little value. The best chance for mother and infant lay in an uncomplicated delivery and a midwife who had the good sense not to interfere much beyond tying off the cord and encouraging the mother to trust in religion and the power of nature.[3,36,38,45,55,83] In some areas the midwives were too numerous, and practice was scanty. In France their fees almost always were wretchedly small, and their economic position was then even more miserable than that of the rest of the peasant population.[38] The social status of the profession was so low, according to Eitel, who has published a commendable study of midwifery in Bavaria, that these women were looked down on even by the barber, the knacker, and the executioner, and the midwife's son might be excluded from a trade guild because of his mother's occupation.[29]

Ignorant, unskilled, poverty-stricken, and avoided as she often was, it is small wonder that the midwife could be tempted, in spite of the teachings of the Church, to indulge in superstitious

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practices and even in witchcraft. If formally accused of the latter, she stood in grave peril of her freedom and her life, but short of this, she could enjoy great if unsavory prestige, a reputation for secret skills, and perhaps an augmented income, as well as the delights of the witches' "sabbath." She could, in fact, capitalize on her new status in the community, professing the power, for a fee, to cure disease, foretell the future, find lost or stolen property, prepare love potions, and so on, as well as claiming special skills at the bedside of the woman in labor.[71]

It must be remembered that at this time, and for centuries before, the practice of witchcraft was real and widespread in Europe.[47,61] Persecution and prosecution of real and alleged witches began to spread across Western Europe by the fourteenth century.[47] In each of the waves of repression which mounted from time to time, accusations of witchcraft were numerous.[92] Many of the charges were false, and many "confessions" were extracted by threats and torture.* But ecclesiastical authority, civil government, and the laity believed in the reality of witchcraft, and here and there it was practised and the rites of the witches were quietly but undoubtedly performed. In the minds of educated and ignorant alike, the powers of evil and forces of good were seen locked in earthly combat for the possession of men's souls. Each man must align himself with one side or the other.

The repression of the witches had the support of the highest authorities. James I, for example, considered himself an expert on sorcery. He was so incensed by Reginald Scot's courageous questioning, in his *Discoverie of Witchcraft*,[75] of popular beliefs about magic and its practitioners that the King not only wrote his own *Daemonologie* in 1597 (when he was still James VI of Scotland) to set the record straight but saw to it that all available copies of Scot's book were burned.[22] (A few survived.) The Church had long since taken an implacable stand. Pope Innocent VIII denounced witchcraft in his Bull of 1484.[84] Two Dominican Inquisitors, Sprenger and Kraemer, in 1489 published the *Malleus maleficarum*, a grim textbook, even for those harsh days, of detailed

* In assessing the confessions of the witches it is important to remember that, as Hughes points out, their statements in England, where torture was illegal, in general agree with those made on the Continent. "Many witches gladly testified, in all countries, to the crimes which they were said to commit. . . . Witches, as much as their questioners, believed in their powers for evil. . . ."[47] Sir William Blackstone, renowned jurist, commenting on the English witchcraft laws repealed in 1736, says, "These acts continued in force until lately, to the terror of all antient females in the kingdom; and many poor wretches were sacrificed thereby to the prejudice of their neighbours, and their own illusions; not a few having, by some means or other, confessed the fact at the gallows."[9,87]

directions for the detection, conviction, and punishments of witches and sorcerers. In the next two hundred years this work went through at least 19 editions.[82,92] In view of the opposition of Church and State to witchcraft and of the terrible penalties imposed on convicted offenders, it is remarkable that anyone deliberately practised the black arts. Yet according to Margaret Murray, a leading contemporary authority on the subject, witchcraft existed as a pagan religion in England until the nineteenth century and survives today in Italy and France.[60,61] Great crowds attended some of the "sabbaths" at which the Devil was worshipped. In earlier times not only the laity but sometimes even members of the Christian clergy were involved, a fact which accounts in part for the vigor with which the Church sought to root out this heresy.[19]

What was a witch? Murray quotes the definition by Lord Coke (1552-1634), English jurist—"a person who hath conference with the Devil to consult him or to do some act,"[61] a description which echoed that given by Jean Bodin.[19] Sir William Blackstone wrote in 1773:

> To deny the possibility, nay, actual existence of witchcraft and sorcery is at once flatly to contradict the revealed word of God, in various passages both of the old and new testament: and the thing itself is a truth to which every nation in the world hath in its turn borne testimony, by either examples seemingly well attested, or prohibitory laws, which at least suppose the possibility of commerce with evil spirits.

After some examination of the problem, Blackstone suggests: "Wherefore it seems to be the most eligible way to conclude, with an ingenious writer of our own [Joseph Addison in *The Spectator*], that in general there has been such a thing as witchcraft; though one cannot give credit to any particular modern instance of it."[9] Very few would now accept the possibility of an actual compact or contact with the powers of evil. We can instead subscribe to the definition, supported by Webster, of a witch as an individual who was *believed* to be in league with the Devil and to practise black magic.[62] By this criterion there were witches aplenty.*

The question arose as to the extent to which European midwives of the fifteenth to seventeenth centuries engaged in witchcraft as last defined. An excellent introduction to the problem and to the literature was provided by Aveling's book, *English Mid-*

* Superstitious practices and beliefs were not necessarily also a part of witchcraft but were related to the extent that they involved, as they still may, a non-scientific attitude toward nature or the supernatural.

wives, to which the author expresses his special indebtedness.[3] A careful search uncovered much additional information.

The moment of birth, a climax and a beginning, has ever aroused the imagination. Several aspects of the birth process at various times have acquired special meanings. Superstition surrounded the placenta, the umbilical cord, and the caul, the piece of amniotic membrane which at birth may still cover the infant's head. The caul was believed to confer eloquence and protection against drowning, to promote easy childbirth, and to bring various other pieces of good fortune. (For reviews see Forbes and Kanner.[32,50]) The midwife on occasion was accused, apparently with reason, of stealing the caul so that she could sell it to a witch as an ingredient of a potion. The Wurzburg regulations for midwives as issued in 1555 forbad them either to carry off or to bury the placenta, and specified that it be cast into running water.[55] Guaccius in his *Compendium maleficarum* speaks of the use in the Black Mass of candles made of pitch or of the umbilical cord of an infant.[41] The best known of seventeenth century French midwives, Louise Bourgeois, in her text book warned her colleagues that they should never keep the caul, as it might be used by sorcerers,[13] and John Cotta echoed earlier charges that witches use parts of babies for dreadful purposes.[21] Section 28 of Paragraph 43 of the *Brandenburgische Hebammen-Ordnung* of 1743 stated: "No midwife shall secretly pass on or sell to questionable persons for misuse and perpetration of most damnable wickedness the so-called string or navel cord, afterbirth, *Helmlein* and *Kleidlein* [caul] which the baby brings with it into the world; if this occurs, she will be very severely punished."[54]

Similarly, the *Abrégé de l'embryologie sacrée,* also dating from the eighteenth century, cites an ordinance of the Church which makes the same restriction: midwives "will never give a portion of the placenta to anyone for superstitious purposes."[26] The repetition of this prohibition certainly implies that it was not always observed, and indeed it must sometimes have been easy for the midwife, if she dared, to steal the by-products of childbirth.

Just as witchcraft at its roots, according to Murray, was essentially a pagan and debased religion—the worship of the Devil—so attendance at the witches' sabbath, at which the rites of worship were performed, was a fundamental duty and privilege for the witch.[60,61] Whether attendance was actual or, as sometimes (see below), no more than a drug-induced delusion, it was customary

first for the devotee to smear his or her unclothed body with an unguent, the famous "witch's ointment" or "flying ointment." Grillot de Givry says that in Arras in 1460 several individuals accused of witchcraft confessed that when they were ready to attend the sabbath, they rubbed the ointment on their bodies, "then flew off where they wished, past beautiful cities, woods, and streams, and the Devil carried them to the place where they were to have their assembly."[40] A typical account was that of Jehanette Otheniaz of Bâle, as reported by Diricq: She went to the sabbath "always at night; her master carried her on his back. She left the house either by the window or the chimney. Sometimes she had the impression of riding a beast much smaller than a ram; at other times she greased a rod with the unguent which her master had given her. She was burned 25 May 1597."[27]

Martin Delrio, relentless pursuer of witches, asserts that at the sabbath the Devil was accustomed "to smear the front of [his] staff with an ointment compounded of various strange things, chiefly the fat of slain infants." So that the supply of ointment would be plentiful, "a large number of infants are slaughtered."[25] Here speaks the fanatic. However, there is no doubt that such ointments were prepared and that the fat of babies was considered an essential ingredient. Since it was greatly preferred, if not imperative, that the baby not have been baptised, the body of a newborn child usually had to be procured.[12,23,40,47,56,60,75] The midwife, if she were a witch or the agent of a witch, could then play an important role. The *Malleus maleficarum* was explicit on this point.[82] Part I, Question XI, charges that witch-midwives destroy the child *in utero*, causing an abortion, or find a moment of privacy in which to offer the newborn infant to Satan. In Strasburg, the book relates, a mother who refused the services of a certain midwife was subsequently bewitched and suffered greatly. A Swiss midwife was said to have confessed the murder of over forty infants by piercing their heads with a needle during delivery. Again and again the authors of the *Malleus maleficarum* refer to witch-midwives in the most condemnatory terms — "commit most horrid crimes . . . surpass all other witches in their crimes . . ." It is difficult, if not impossible, to separate the actual from the imagined offenses, but there can be no doubt of the utter vindictiveness toward any midwife who was suspect.

The composition of the ointment is of interest in view of its alleged effects. Giovanni Battista della Porta, sixteenth century

physician, naturalist, and cryptographer, gives the following account of the *Lamiarum vnguenta:*

> They [the witches] take the fat of infants from a watery decoction in a brazen vessel, [fat] which is left after the final boiling off and settling of the mixture, whereupon they collect and preserve it for their continuing benefit: with this they mix eleoselinum [celery], aconitum, poplar leaves, and soot. Or ANOTHER [formula] is thus: sium [a kind of parsley], common sweet flag, cinquefoil, bat's blood, deadly nightshade, and grease, and they mix these diverse ingredients. . . . So they [the witches] are seen on moonlight nights being born off through the air to banquets, sounds [of music], dancing & lovemaking of handsome young people, all the things which they most greatly desire. So great is the power of imagination, the manifestation of impressions, that that part of [their] brains which is said [to contain] memory is full of this kind of thing. . . .[68]

Jerome Cardan, physician, mathematician, and gambler and a contemporary of Porta, echoes the latter:

> Just as the [good] dinner which has been eaten makes sleep [i.e., dreaming] pleasant, so colewort [a kind of cabbage] makes it sad, pulse makes it restless, and garlic makes it dreadful. Hence from such things is born the belief of the witches, who by consuming parsley, chestnuts, beans, onions, colewort, and peas see themselves in their sleep carried to various places and there affected in various ways according to the season. Therefore they take delight in this ointment, which they smear all over themselves. It consists, if it is to be believed, of the fat of infants torn from graves and the juices of parsley and nightshade, as well as of cinquefoil and soot. Incredibly they [the witches] may persuade themselves that they have seen large areas, theaters, green gardens, fishing, garments, adornments, dancing, handsome young men, and lovemaking of whatever kind they most desire. . . .[18]

The similarity of these two passages suggests that both may have been drawn from a common and still earlier source. Comparable descriptions of witches' ointments are provided by contemporaries of Porta and Cardan, among them Henri Boguet, Reginald Scot, and Jean Wier. Boguet's *Discours des Sorciers* appeared about 1590.[12] Scot[75] and Wier, whose *De praestigiis daemonum* was printed in 1564,[90,91] were two sceptics who had the courage to speak out against the witchcraft superstitions. Both were bitterly attacked, Scot, as we have seen, by royalty itself.

Several studies have been made of the possible pharmacological effects of the ingredients of the "flying ointments." It is unlikely that aqueous preparations of these substances would pass through the skin, but percutaneous absorption of some of the drugs when they are incorporated in a fatty or greasy base is quite possible.[20,79] Thus the fat was an essential component. Absorption is most effective through hairy, thin skin, and it is noteworthy that in the

Arras confession, mentioned above, of persons accused of sorcery, the method of application of the ointment was that "... *ils ondaient une vergue de bois bien petite, et leurs palmes et leurs mains, puis, mectoient celle verguelte entre leurs jambes...*" [with a very small wooden wand they smeared both their hands and their palms, then placed this little wand between their legs]—that is, the ointment was applied in some of the most absorptive cutaneous sites. Scot says that the witches "... rubbe all parts of their bodys exsceedinglie, till they looke red, and be varie hot, so as the pores may be opened, and their flesh soluble and loose. They joine herewithall fat, or oile in steed thereof, that the force of the ointment maie the rather pearse inwardly, and so be more effectuall."[75]

Soot often appears as an ingredient, perhaps because the color is appropriate. It is unlikely that the bat's blood and most of the herbs used had any effect, but for *Aconitum* (monkshood) and deadly nightshade it was a different story. The former depresses the cardiovascular system, acts on the central nervous system, and produces sensory paralysis. It can be absorbed through the skin to give a systemic effect.[79] Atropine, present in deadly nightshade and also absorbable percutaneously when in a suitable base,[20] in sufficient doses causes excitement, delirium, and unconsciousness. De Chesnel relates that when in 1545 an ointment was found in the possession of a sorcerer who had been arrested, the physicians of Pope Julius III tested the substance by applying it to the body of a woman suffering from a nervous disease. She slept for 36 hours, then awoke to describe various strange but pleasant hallucinations.[23] Atropine may have been an ingredient of this ointment. Scot quotes Porta to the effect that a witch who offered in prison to demonstrate the ointment smeared herself with it, "fell down through the force of those soporiferous or sleepie ointments into a most sound and heavie sleepe," and could not be roused even by a severe beating. When she awoke, she described travels "over both seas and mountains."[75] A Swedish couple and their dog in 1793 ate pieces of bread smeared with a black witch's ointment which had been discovered in a sawed off cow's horn. They were observed to sleep for several hours, then to make violent movements. Later the couple reported hallucinations of flight.[37] In modern clinical studies, strange dreams, travel, fantasies, and hallucinations followed the injection of scopolamine or the inunction of a tincture of celery, aconite, and nightshade. On recovery, there was a feeling of fatigue.[73]

Thus it is a plausible theory (suggested by Scot) that if a witch wished to attend the sabbath, her ignorant mind already filled with expectations of the great event, she needed only to smear her body with one of the potent ointments known to the elect.[75] Soon she would experience hallucinations, sink into delirium, and next day awaken exhausted by what she supposed had been her long journey.[73]

Norman, on the other hand, concludes that not much of any ingredient could have been absorbed through the skin, since he feels that the concentrations of the drugs must have been low. He attributes the illusions to self-suggestion.[64] The theory of pharmacological effects from the witches' ointment is completely rejected by Snell, who smeared his own body with a mixture of aconite and grease without any of the anticipated results.[78]

As witchcraft was prominent in popular interest, it of course made its way into literature, and there one finds childbirth superstitions, the witch-midwife, and the witches' ointment. Rösslin's preface to his *Der swangern Frawe[n] und hebamme[n] roszgarte[n]*, one of the earliest European printed works on obstetrics, devotes much of a rather long poem to the iniquities of the midwife.[53,74] Although he does not actually call her a witch, he accuses her of destroying children "far and wide" and depriving them of holy baptism. Later in the sixteenth century John Bale wrote *A newe comedye or enterlude/concernying thre lawes.* In the second act "Idolotria" boasts:

> And a good mydwyfe perde
> Yonge chyldren can I charme:
> With whysperynges and whychynges
> With crossynges and with kyssynges
> With blasynges and with blessynges
> That sprytes do them no harme.[6]

Thomas Middleton drew heavily on Scot's *The Discoverie of Witchcraft* when he wrote in 1609 or 1610 his lurid play, *The Witch.*[31,58] In Act I, Scene 2, Hecate is directing the preparation of the brew which was a professional specialty:

> *Hec.* there take this vn-baptized-Brat
> Boile it well: preserve the ffat,
> you know 'tis pretious to transfer
> our 'noynted fflesh into the Aire,
> in Moone-light nights, or Steeple-Tops. . . .

A little later the following ingredients for the witches' ointment were mentioned:

I thrust in *Eleoselinum* lately
Aconitum, frondes populeus and *Soote*
. . . .
then *Sium, Acharum, Vulgaro* too
Dentaphillon, the Blood of a fflitter-mowse
Solanum Somniferum et Oleum.

The recipes apparently are directly from Porta (see above).[68] The *oleum* of course was of human origin. A few pages farther on, Hecate's son remarks that some one "stumbled at a Pikin of Childes Greaze," and in Act V, Scene 3, she informs the audience, by this time spellbound on their benches by gruesome detail (and no doubt enjoying every moment), how she feeds the ravens and screech owls which fly by her door—"I give 'em Barley, soak'd in Infants-Blood. . . ."[58]

Shakespeare is thought to have derived many of the witchcraft details in *Macbeth* (written about 1605 but not published until 1623) from Scot's book and from records of Scottish witchcraft trials.[22] If indifferently acted, the witches' "incantation scene" now seems rather silly. Probably this passage was not humorous to seventeenth century playgoers. It is an interesting possibility that at more than one performance a real witch in the audience listened critically to the actor-witches on the stage as they recited the ingredients of their brew:

Finger of birth-strangled babe
Ditch-deliver'd by a drab.

Could ten words call up a more vivid picture?

In writing *The Lancashire Witches,* published in 1691, Thomas Shadwell drew all technical details (and the play is crammed with them) from well-known books on witchcraft. In the preface he tells us,

. . . there is not one Action in the Play, nay scarce a word concerning it, but is borrow'd from some Antient, or Modern Witchmonger Which you will find in the Notes, wherein I have presented you a great part of the Doctrine of Witchcraft, believe it who will. For my part, I am (as it is said of Surly in the Alchymist) somewhat costive of belief. The Evidences I have represented are natural, viz. slight, and frivolous, such as poor old Women were wont to be hang'd upon.

Mother Demdike, a witch (and a character said to have been drawn from life), boasts (Act I):

To a Mothers Bed I softly crept,
And while th' unchristn'd Brat yet slept,
I suckt the breath and bloud of that,

And stole anothers flesh and fat
Which I will boyl before it stink;
The thick for Oyntment, thin for drink.[76]

The midwife who was not a witch sometimes resorted to spells and charms to protect and help the parturient woman and her infant. The eagle stone or *aetites,* known since antiquity, was not only considered effective but its use had the approval of the Church, as shown by a passage said to appear in a catalogue of Dr. Bargrave's Museum, "bequeathed to Christchurch, Canterbury, in 1676." Dr. Bargrave was Dean of Canterbury Cathedral. His eagle stone, bought in Rome from an Armenian,

. . . is so useful that my wife can seldom keep it at home, and she therefore hath sewed the strings to the knitt purse in which the stone is, for the convenience of the tying of it to the patient on occasion, and hath a box to put the purse and stone in. It were fitt that either the Dean's (Canterbury) or vice-dean's wife (if they be marryed men) should have this stone in their custody for the public good, as to neighbourhood; but still, that they have a great care into whose hand it be committed, and that the midwives have a care of it, so that it shall be the Cathedral's stone.[49]

The eagle stone is discussed elsewhere in some detail.[7,14] Strype's *Ecclesiastical Memorials* includes a list, evidently dating from the seventeenth century or earlier, of the sacred relics at the convent of St. Austin in Bristow, England. The letter of inventory states: ". . . I send you also our Ladies girdle of Bruton, red silk. Which is a solemn relic, sent to women travailing, which shall not miscarry *in partu.* I send you also Mary Magdalene's girdle; and that is wrapped and covered with white; sent also with great reverence to women travailing."[80] A variety of other sacred objects, charms, and procedures were employed as protective measures in childbirth.[4,34,46,62]

In quite another category were the witchcraft rites sometimes conducted during or after delivery. These of course were condemned by Church and State. Because midwives of the fifteenth to seventeenth century so often were in bad repute, even an innocent practitioner might be accused of witchcraft if the delivery had an unhappy outcome or if the non-obstetrical patients whom some midwives attempted to treat did not recover. For example, a certain Ursley Kemp, midwife, nurse, and remover of spells from the sick, was brought to court as a witch in 1582 apparently just because she was a suspicious character.[65] The Devil, according to the Augsburg *Hebammenordnung,* could trick the midwife into using incantations. A priest in Breslau no doubt summed up

popular opinion in 1494: *in partu obstetrices mille demonica operantur similitur et partientes*—in childbirth the midwives are concerned with a thousand devilish things as well as with the women in travail.[4]

Even more serious were the charges of infanticide by midwives. Such accusations were recorded as early as about 1460.[56] Frommann's *Tractatus de fascinatione* says, "The Devil arranges through the midwives not only the abortive death of the fetuses lest they be brought to the holy font of baptism, but also by their [the midwives'] aid he causes newborn babies secretly to be consecrated to himself."[35]*

Lea quotes from Jaquier's *Flagellum hereticorum fascinariorum* of 1581 a charge that midwives often strangle the newborn child on command of the Evil One, one woman thus having, she confessed, prevented the baptism of twenty-three babies.[56] Three of the women tried for witchcraft at Schongau, Bavaria, in 1589 were midwives; one of them is said to have stated that she could cause the death of the fetus *in utero*.[29,46] Boguet makes a similar charge and adds that the midwife may offer the newborn child to Satan and then kill it by thrusting a bodkin into the brain.[12] The accusation appears again in Hiltprandum's late sixteenth century book on midwifery[45] and in Guaccius' *Compendium maleficarum* of 1626. The latter continues:

> Moreover, when they do not kill the babies, they offer them (horrible to relate) to the demons in this execrable manner. After the child is born the witch-midwife, if the lying-in mother is not alone, pretends that something should be done to restore the strength of the baby, carries it outside the bedroom, and elevating it on high, [offers] it to the Prince of Devils, that is to say, Lucifer, and to all the others. . . .[41]

Such a consecration to the Evil One was reported to have occurred in Scotland. The justices of the peace, it was said, were observed in conversation with the Devil; one of the justices was alleged to have handed over his newborn only child, "stepping out with it in his arms to the staircase, where the devil stood ready, as it was suspected, to receive the innocent victim."[59,77]

There were other cases. In 1481, when the bishop visited York Minster several members of the parish were "presented" to him for violations of church law. One presentment was from the village of "Driffield Parva . . . Agnes Marshall, alias Saunder, de Emeswell,

* If it was discovered that an infant had been promised to the Devil, a benevolent midwife could break the charm on the sixth night after birth by placing a holy candle inside a circle drawn on the floor, cutting a lock of hair from the baby, and throwing the hair to the Evil One.[4]

exercet officium obstetricis, et non habet usum neque scienciam ostritricandi; utitur etiam incantationibus [Agnes Marshall . . . practises the profession of midwife without having either experience or knowledge of midwifery, and moreover she uses incantations]."[52,70] Just a hundred years later Jean Bodin, a judge who had tried many witches, wrote: "another notorious witch living in Verignius (where her life ended last April) was a midwife who had been accused of certain acts of witchcraft but who was acquitted; later she horribly avenged the accusation by causing the destruction of uncounted men and beasts, as we have heard from the inhabitants."[11]

Depositions in the records at York Castle cover numerous offenses, among them a surprising number of cases of witchcraft. For example: "CXXXIV. Mrs. Pepper. For Using Charms, Etc. Feb. 3, 1664-5, Newcastle-on-Tyne, before Sir Francis Liddle, Kt., mayor. Margaret, *wife of Robert Pyle, pittman,* sayeth, that aboute halfe a yeare agoe, her husband, being not well, sent his water to Mrs. Pepper, a midwife, and one that uses to cast water." That is, Mrs. Pepper professed to diagnose illness by examination of the patient's urine. She was charged with having bewitched Pyle but was evidently found not guilty.[71]

A belief in fairies of course was widespread in Europe, especially in rural areas. One of these creatures' tricks, supposedly, was to steal a newborn, unbaptized infant, perhaps leaving a "changeling," a soulless and misshapen child of the fairies, in the human baby's place. Infants with congenital defects were sometimes believed to be changelings.[43,44] Some inhabitants of Scotland believed that every seven years the fairies had to pay "the teind to hell," a tribute to the Devil of a fairy baby, unless the fairies could steal and substitute a human infant.[39] An English midwife's oath of 1567 included the promise at childbirth not to substitute any other infant or infant's body for the natural child of the mother.[42] One of the reasons for this restriction may have been concern about changelings. In Germany, Iceland, and Scotland, incidentally, it was widely believed that midwives were obliged to deliver pregnant water-sprites, the midwife being richly rewarded if she cooperated but dying by drowning if she did not.[88]

The greatest dread of those who waited by the woman in travail was that she and her child might lose their souls.[48] As Hastings says, ". . . the mother is no longer a real Christian until she is churched, for she has been despoiled of her Christianity

by the child in the act of birth."[43] The child was not a Christian until it was properly baptized. Until this protection was conferred, the infant was considered to be in deadly peril from the powers of evil. Further, as Margaret Murray points out, there is clear proof that ". . . the personage called by Christian writers 'the Devil,' was considered by the witches themselves to be God incarnate as a man. To this deity they made sacrifices of various kinds, the most important of such sacrifices being that of a child. The child was either a witch's child, or unbaptized; in other words, it did not belong to the Christian church."[59] This, in the opinion of Scot and Boguet, was why the witches and the witch-midwives made every effort to obtain the infant before baptism, although Scot did reject Bodin's notion that witches "sacrifice their own children to the devil before baptism."[12,75] Wier quotes another authority to the effect that the witches "lie in wait for infants not yet baptized, or actually baptized, particularly when they are not protected by the sign of the cross and prayers"—that is, when they have been improperly baptized.[90] Such superstitious fears provided one urgent reason for prompt baptism. The other reason, of course, was the traditional belief that the soul of the unbaptized child must abide forever in limbo.

If a priest was not at hand and it was evident that the newborn infant would not long survive, the midwife might be expected to take the baby to the priest. The renowned midwife Mme. Le Boursier du Coudray in her manual, *Abrégé de l'art des accouchements,* remarks ruefully: "There is usually some danger in carrying infants to baptism during the night, especially in the rural parishes: the bad roads, ditches, planks, places one must jump over, ice, bad weather, encounters with dogs &c."[57] In an emergency, properly qualified midwives were authorized and instructed to baptise the baby according to the laws of the Church, as they may to this day.[8] Rösslin, the sixteenth century obstetrician, held the midwife responsible if the baby died without proper baptism and was consequently never admitted to salvation.[53,74]

An interesting case is recorded in the Consistorial Acts of the diocese of Rochester, England:

1523, Oct. 14—Eliz. Gaynsford, *obstetrix, examinat' dicit in vim juramenti sui sub hac forma verborum.*—'I, the aforesaid Elizabeth, seeing the child of Tho. Everey, late born in jeapardy of life, by the authorite of my office, then beyng midwyfe, dyd christen the same childe under this manner, In the name of the Fader, the Son, and the Holy Ghost, I christen thee

Denys, *issundend' meram aquam super caput infantul.'—Interrogata erat,* Whether the child was born and delivered from the wyfe of the said Thomas; whereto she answereth and saith, that the childe was not born for she saw nothyng of the childe but the hedde, and for perell the childe was in, and in that tyme of nede, she christened as is aforesaid, and cast water on the childe's hede. After which so done the child was born, and was had to the churche, where the Priest gave to it that chrystynden that takkyd, and the childe is yet alyf.[86]

An East Sussex parish register: "1579. Was baptized Joan Birmingham, the daughter of John Birmingham and Joan his wife, by the midwife at home, and it was buried on the 20th day. . . . "[10] Another: "St. Mary's Litchfield, Oct. 12, 1591. Margarett, dr. of Walter Henningham de Pypehall, baptized by the midwife, and, as yet not broughte to ye churche to be there examined and testified by them that were present."[3] In the British Museum Library is a very rare and fragile pamphlet, dating from about 1530, entitled *Eyn unterricht für die hebammen/wie sie in der not Tauffen sollen*—instructions for midwives as to how they should baptize in case of need.[1]

It is interesting that baptism by the midwife in case of urgent necessity had the sanction of the Church as early as the seventh century. Aveling quotes a ruling in the *Liber Poenitentialis* of Theodore, Archbishop of Canterbury: *"Mulier baptizare non praesumat, nisi cogenti necessitate maxima"*—the woman may not presume to baptize except when compelled by extreme necessity.[3] A decree of the Council of Bourges in 1584 (Titre IX, Can. 8) is similar: "Neither midwives nor lay persons may anticipate baptism, nor may they presume to confer it, except in extreme necessity and evident danger."[26] The midwife was bound under peril of mortal sin to know and to use the proper ritual when she baptized an infant,[24,26,30,85] and the clergy was specifically charged with instruction of midwives in the administration of this rite.[3,5,8,17,26,30,34] Baptisms, it is said, were performed by some English midwives until early in the seventeenth century,[3] although it appears that by 1577 the practice had been forbidden in Protestant households.[69]

Both Church and civil authorities made strenuous efforts to regulate the practice of midwifery. The first municipal ordinances for this purpose in Europe are believed to be those in the *Hebammenordnung* of Regensburg, dating from 1452.[15,28,46] The first regulations of the Church which have been recorded seem to be those of the Wurzburg Synodal Statute of 1491.[4] In general

the ordinances dealt with the proper training of the midwife, her equal availability to rich and poor, the circumstances in which she should seek the help of a physician, and so on. But regularly evident was a continuing concern lest she indulge in "superstitious practices" or outright witchcraft. Under the Wurzburg statutes, "the midwife hereby is strictly prohibited from employment of any superstitious practices."[2] Wirtemburg in 1552 forbad "superstitious sayings or other ungodliness" during the delivery.[16] Church law provided that "Those baptized by the midwives are to be re-baptized in instances when the midwives are suspected of witchcraft. . . ."[30] The city of Heilbronn forbad both midwives and women in labor to employ *alle aberglaubische wort werk und geberden*—all superstitious words, acts, and gestures.[16] Regensburg in the sixteenth century was stringent: "Whatever midwife employs magic or superstitious methods shall accordingly be beaten."[16] The *Gothäische Landesordnung* of 1658 prohibited witchcraft at childbirth.[4] The *Wurzburg-Mainz-Wormser Kirchenordnung* of 1670 specified that ". . . no one is permitted either to induce or to palliate the birth or to employ superstitious methods for mother or child." Similar wording appears in a German ordinance of the eighteenth century.[15, 16] The frequent reference by the regulations to witchcraft leaves little doubt that the midwives continued to fall under suspicion. As late as 1814, the municipal ordinances of Bâle forbad midwives to employ superstitious methods.[51]

In the smaller communities the midwife was sometimes selected by the priest from among the virtuous older women of the parish; one requirement was that she "had never been suspected of heresy or witchcraft,"[38] or that she be "free of all suspicion of heresy, witchcraft, superstition, or any other crime whatsoever, and finally that she be of exemplary life and morals."[5]

In addition, it was the custom for the bishops periodically to visit the parishes in their dioceses and to inquire most carefully of the local clergy about various matters. Many of the visitations have been recorded; they often mention the witchcraft problem. The clergy of the dioceses of Gloucester and Worcester, England, in 1551-1552 were required to know ". . . whether the midwives at the labour and birth of any child . . . do use any salt, herbs, water, wax, cloths, girdles, or relics, or any other such like thing or superstitious means contrary to the word of God and the laws of the realm."[34]

The injunctions laid down by Bonner, Bishop of London, in 1554-1555 directed that the clergy determine, "Whether any midwife or other woman, coming to the travail of any woman with child, do use or exercise any witchcraft, charms, sorcery, invocations or prayers, other than such as be allowable, and may stand with the laws and ordinances of the Catholic Church?"[3, 34, 42, 52, 67] At another visitation in 1559, made in this case by representatives of Queen Elizabeth I, it was asked, "Whether you knowe anye that doe use charmes, sorcerye, enchauntments, inuocations, circles, witchcrafts, soothsayinge, or any lyke craftes or ymaginations inuented by the Devyll and specyallye in the tyme of women's travayle."[3, 33, 67]

In "the province of Canterbury" in 1571 and 1576 an article of the visitation asked: "Whether there be any among you that use sorcery or witchcraft, or that be suspected of the same, and whether any use charms, or unlawful prayers, or invocations in Latin or otherwise, and namely midwives in the time of women's travail of child; and whether any do resort to any such for help or counsel, and what be their names?"[63]

Item 46 of Archbishop Parker's articles of visitation for Winchester Diocese in 1575 read: ". . . whether midwives . . . use in the time of women's travail any witchcraft, charms, Latin prayers or invocations. . . ."[33]

Richard, Bishop of Durham, in 1577 charged his clergy and churchwardens ". . . from tyme to tyme to present the names and surnames of all suche women as shall . . . at the childes birth use superstitious ceremonyes, orizons, charmes, or develishe rytes or sorceries."[69]

At a visitation made in St. Mary's, Salop, in Shrewsbury in 1584, one of the 90 questions asked was, "Whether any mydwife within your parishe in time of weomens travill be knowne or suspected to use sorcerie, witchcrafte, charmes . . . or to saye unlaweful praiers or superstitious invocations."[66]

A further attempt to insure that the midwife practised her profession according to acceptable standards was the requirement that she take an oath of office, usually after she had been examined as to her competence and knowledge by medical or ecclesiastical authorities, or both. The oath was a prerequisite for licensure.[8] An English midwife's license in 1675, issued after a verbal examination, stipulated that ". . . you shall in no wise exercise any manner of witchcraft, charms, sorcery, invocation, or other prayers, than

such as may stand with Gods laws, and the kings,"[10] and a license issued 14 August 1686 by the Bishop of London to one Ellen Perkins included this restriction in nearly identical words.[89] Nuremberg midwives at the end of the fifteenth century had to promise to ". . . entirely abstain from harmful . . . and superstitious means."[16] An English midwife's oath, administered at Canterbury in 1567, deserves quotation at some length; it speaks for itself.

> I, Eleonor Pead, admitted to the office and occupation of a midwife, will faithfully and diligently exercise the said office according to such cunning and knowledge as God hath given me: and that I will be ready to help and aid as well poor as rich women being in labor and travail of child, and will always be ready both to poor and rich, in exercising and executing of my said office. Also, I will not permit or suffer that woman being in labour or travail shall name any other to be the father of her child, than only he who is the right and true father thereof; and that I will not suffer any other body's child to be set, brought, or laid before any woman delivered of child in the place of her natural child, so far forth as I can know and understand. Also, I will not use any kind of sorcery or incantation in the time of the travail of any woman; and that I will not destroy the child born of any woman, nor cut, nor pull off the head thereof, or otherwise dismember or hurt the same, or suffer it to be so hurt or dismembered, by any manner of ways or means. Also, that in the ministration of the sacrament of baptism in the time of necessity I will use apt and the accustomed words of the same sacrament . . . And that in . . . pouring water upon the head of the same infant, I will use pure and clean water, and not any rose or damask water, or water made of any confection or mixture. . . .[81]

At Trier in 1574 the midwife had to swear *"dass ich keinerlei Zaubermittel oder Aberglauben brauchen will"*—that I will employ no magical procedure or superstitions.[4] The oath required of midwives in 1584-1585 before licensure by the Bishop of Chester included the promises not to use "any witchcraft, charms. . . ."[72] In the eighteenth century the Church of England oath specified, "You shall not in any wise use or exercise any manner of witchcraft, charm or sorcery. . . ."[3] And French midwives in 1775 still had to promise never to use "superstitious words or signs."[24]

Considering all this evidence, what can we conclude? It is well established that witchcraft was widely practised in Europe, and we can be sure that the midwife was tempted to enjoy its forbidden delights. Undoubtedly there were opportunities for her to use witchcraft professionally. Many times she was accused of practising the black arts, often unjustly but sometimes, it appears, quite correctly. What proportion of the midwives were involved in witchraft cannot be determined. The records, even when factual,

are chiefly accounts of wrong-doing. Then as now, good deeds went unnumbered, and we must presume that law-abiding midwives, if not unrewarded, still were usually unmentioned. Probably the considerable majority abided conscientiously by their oaths. Yet one cannot avoid the conclusion that there were some who did not. Perhaps the most convincing evidence is indirect—the manifest concern of both local governments and the Church, which for more than three hundred years by municipal ordinance, episcopal injunction, pastoral exhortation, examination, and oath sought to stay the midwife from "all manner of witchcraft, charm or sorcery."

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American Manuscript Collections of Medieval Medical Miniatures and Texts

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SEVERAL years ago, Miss Gertrude Annan, Librarian of the New York Academy of Medicine, published a revealing survey of rare medical books in American medical libraries.[1] Although her concern was incunabula and other rare books, she mentioned outstanding manuscript holdings, such as the Edwin Smith Surgical Papyrus at the New York Academy of Medicine and the Paneth Codex at the Yale Medical Library. It is the wealth of medical texts and miniatures in medieval manuscripts now on this side of the Atlantic which leads us to present a survey of American holdings in this field. The survey is merely a summary of the final part of our card listing of "Medical Miniatures in Medieval Manuscripts in Europe and America." In two summers of search in American centers as far distant as Seattle, Los Angeles, Birmingham, and Montreal, we have seen many medical manuscripts, a considerable number of which contain medical miniatures. Among these manuscripts are not only those listed in the original Seymour de Ricci and W. J. Wilson *Census of Mediaeval and Renaissance Manuscripts in the United States and Canada* (1935), but also those recently acquired items listed in the files for the forthcoming *Supplement*, which is being compiled by Dr. W. B. Bond and his assistants at Harvard University.

Restricting ourselves for the most part to *Western* manuscripts prior to 1500 in date, we present the data from illustrated manuscripts by library-location, first the libraries of the Eastern coastal region, where there is the greatest concentration of manuscripts, then those of the Midwest, the Pacific Coast, and the South. We give brief descriptions of all illustrated manuscripts (also notable medical illustrations in non-medical manuscripts); the texts in illustrated and unillustrated manuscripts are given separately in an alphabetical listing. The term "medical" we interpret broadly to include materia medica, pharmacy, anatomy, surgery, obstetrics, orthopedics, etc. We also include encyclopedic works such as Bartholomaeus Anglicus, *De proprietatibus rerum*, because of

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1 "Outstanding acquisitions of rare books in medical libraries of the United States in the last decade." *Bull. med. Lib. Ass.*, 1957, *45*, 291-300.

their lengthy sections on medicine, materia medica, anatomy, etc., also bestiaries if they include significant data on the medical properties of the animals described. Single stray leaves are omitted unless they contain noteworthy medical data.[2]

A. Libraries by Location with Descriptions of Illustrated Manuscripts

LOREN MACKINNEY

In WASHINGTON, D. C. the rare book room of the Library of Congress has a number of manuscripts, none of which is illustrated.[3]

The Freer Gallery of Art has several detached folios of Islamic medical miniatures. Among these are eight folios from a well-known thirteenth-century Arabic Dioscorides.[4] Six of the scenes are pharmaceutical (Freer numbers 32,20; 32,21; 32,22; 38,1; 43,2-a & b); the other two pictures depict Erasistratos with an assistant (no. 47,5) and a mad dog biting a man (no. 53,91). One other miniature at the Freer Gallery (no. 30,76), brought to my attention by Curator Richard Ettinghausen, is a unique example of a medical apparatus—an automatic device for measuring the amount of blood extracted in a cupping operation. It comes from a Mesopotamian Arabic manuscript of the year 1315. Our final item from Washington collections is at the Folger Shakespeare Library. In a beautifully illustrated and decorated manuscript is the diploma of a doctor of medicine and philosophy, awarded by the University of Padua to Honophrius of Foligno in 1550, with a licence to practise in Foligno, dated 1547 (*C.*, p. 284, no. 89.1).[5]

[2] The travel involved in our survey was made possible by a grant from the University of North Carolina Research Council. In our listing of manuscripts we give in parenthesis after each item the shelf number in the local catalogue (if any), and the original *Census* number, or the forthcoming *Supplement* number. We are much indebted to Dr. Bond and his staff for assistance in consulting their accumulated data in typescript. For *Census* we use the abbreviation *C;* for *Supplement, S.* Unnumbered manuscripts have no *Census, Supplement,* or shelf numbers.

[3] Treatises in unillustrated manuscripts are listed below in section B.

[4] Istanbul, Top Kapu Saray, 2148-9. The latter part of the manuscript has been removed and separate illustrated leaves have been sold to collectors and libraries in Europe and America. Hugo Buchthal, "Early Islamic miniatures from Baghdad," *J. Walters Art Gallery,* 1942, *5,* 18-39, presents photoreproductions of all the dispersed leaves, descriptions thereof and (note 1) a list of present owners, most of them in the United States. See also Max Meyerhof, "The background and origins of Arabian pharmacology" etc., in *Ciba Symposia,* 1944, *6,* 1846-1876; and Kurt Weitzmann, "The Greek sources of Islamic scientific illustrations," in *Archeologica Orientalia in memoriam Ernst Herzfeld.* Locust Valley, N.Y., 1952, p. 255f. See below, p. 287 for other folios of the manuscript.

[5] Many such diplomas and licences without illustrations are found in medieval manuscripts, e.g., see *Bibliotheca Osleriana,* MSS 7538ff.

The National Library of Medicine, about to be moved from its temporary home in Cleveland to a new building at BETHESDA, MARYLAND, has a large collection of medical manuscripts, both Western and Oriental. A few of these are illustrated. The usual sketches of surgical instruments (in color) are found in the text of a Guy de Chauliac Chirurgia, dated 1476 (Schullian[6] 509; *S.* 25). An anatomical sketch of a human head, neck, and thorax, showing sensory centers and a comically accentuated nose, occupies the last page of an incunabulum containing a printed commentary on Aristotle, *De anima* (Schullian 274). The final page of another incunabulum of Aristotle (Schullian 379) has a similar illustration showing not only sensory centers but also the lungs, heart, stomach, liver, and spleen. A diagram of the eye appears in a sixteenth-century manuscript (Greek, Latin, and German) in a treatise entitled *De anatomia affectibus et curatione oculorum* (*S.* 70).[7]

The Library's collection of Oriental manuscripts, one of the most notable in the Western Hemisphere, contains two fifteenth-century Persian manuscripts of the famous Mansur Anatomy (Sommer, P 18, P 19), each with the typical Islamic *Fünfbilder*, which we shall note at the Yale and Osler libraries and at the University of Kansas Medical Center. These two manuscripts are remarkably early examples, and both have a sixth illustration, a pregnant woman. Another Persian manuscript, of later date and concerning general medicine (Sommer, P 5), contains an inserted anatomical illustration of internal and external organs. Other undated Persian manuscripts of the early modern period have water colors of animals and monsters in a treatise on the wonders of the world (Sommer, P 3) and six pages of anatomical illustrations in a medical treatise (Sommer, P 20). A Turkish treatise on wonders of the world (Sommer, T 1) and two undated early modern Arabic treatises on physiognomy (Sommer, A 58) and alchemy (Sommer, A 65) have illustrations relating to their respective subjects. Finally, a Persian translation of a Hindu treatise on sexual intercourse (Sommer, P 24) has twenty-two miniatures.

In BALTIMORE, the Johns Hopkins Institute of the History of Medicine has no original manuscripts with miniatures, but its collection of photo-reproductions of medical manuscripts in Euro-

[6] Dorothy M. Schullian and Francis E. Sommer, *A catalogue of incunabula and manuscripts in the Army Medical Library*, New York, 1951. We cite the manuscripts by number, using "Schullian" for the Early Western, and "Sommer," for the Islamic manuscripts.

[7] We cite this late manuscript, as also certain Islamic manuscripts, because of their distinctly medieval character.

pean libraries, the result of the late Dr. Henry Sigerist's indefatigable work with his Leica camera, is an invaluable repository of early *medica mediaevalia.* Dr Harry Friedenwald's medical manuscripts, listed in the *Census* (p. 2293) as located in Baltimore, are now in Israel at the National Library.

The Walters Art Gallery, widely known for its illuminated treasures, has two illustrated medical manuscripts. In a fourteenth-century Averroes *Colliget* (Ms. 136; *S.* 287) each section is introduced with a neat, brightly colored and gilded initial portraying the doctor-author lecturing, various types of patients, and a family at a table eating the proper kinds of food. A fourteenth-century French version of Vincent de Beauvais' encyclopedia (*Miroir historiale* (C 506) depicts Siamese twins alongside a passage concerning the recorded phenomenon of their birth. More notable, however, in the Walters collection are the non-Western manuscripts. A twelfth-century Arabic version of Dioscorides (MS. 750) has several herbal and bird illustrations; a fifteenth-century leaf from an Arabic history by Rashid ad-Din (MS. W. 676, E) portrays the birth of Buddha in a realistically bloody, full-page obstetrical scene. One of several leaves from a sixteenth-century Hindu history (MS. 10. 668) depicts a physician administering a pill to a dying prince. One other leaf (MS. W. 675), from a famous thirteenth-century Arabic version of Dioscorides,[8] pictures two physicians preparing medicine.

In PHILADELPHIA, the College of Physicians has a formidable collection of unillustrated medical manuscripts. Princeton University is less endowed with medical than with other types of manuscripts. For great concentrations of medical manuscripts one must look further north.

NEW YORK CITY. The New York Academy of Medicine (like the Frick Art Reference Library, the Johns Hopkins Institute of the History of Medicine, and the private collections of Lynn Thorndike at Columbia University and of Loren MacKinney at the University of North Carolina) has a rich store of medical manuscripts *in photo-reproductions;* also a number of originals. Next to the fabulous Edwin Smith Surgical Papyrus, the most noteworthy of its illustrated medical manuscripts is a thirteenth-century *Chirurgia* of Albucasis, embellished with two cautery scenes (two others are missing) and over 150 red-ink sketches of cautery and surgical instruments inserted in the text with captions (e.g., *forma*

[8] See above, note 4.

olivari, etc.). The manuscript also contains unillustrated treatises of Rogerius Salernitanus, *Chirurgia*; *Chirurgia equorum*; Caelius Aurelianus, *Gynaecia*; *Liber Trotulae sanitatis Salernitanae de curis mulierum*; Priscianus, *Gynaecia*; and Cleopatra, *Gynaecia.* Another surgical manuscript, a fourteenth-century English version of Guy de Chauliac (*C.* 12), has a considerable number of sketches of instruments inserted in the text. Two leaves from a fourteenth-century Bernardus de Gordonio, *De conservatione vitae humanae,* are illustrated with initials in which physicians are shown lecturing and taking a patient's pulse. A fourteenth-fifteenth-century compendium of medical works in Latin and Italian (*C.* 4) contains William of Saliceto's (Guillermus Saliceto) *Surgery* with a badly rubbed introductory initial portraying the doctor-author holding a book; there are also Latin treatises in the second part of the manuscript on surgery, poisons, baths, stones, and prescriptions.

The Pierpont Morgan Library is a mecca for those who love manuscript miniatures. One of its illustrated medical manuscripts, known the world over, is an early tenth-century Greek Dioscorides (*C.* and *S.* 652). Much like the famous Vienna Dioscorides, almost every page is decorated with colored illustrations of herbs and occasionally with an example of animal or mineral materia medica or of pharmaceutical utensils. The last few folios have scenes from Nicander's *Alexipharmaca.* Less famous, but in some ways more interestingly illustrated, is a fourteenth-century materia medica picture book, without explanatory text but captioned in Latin (S. 873). Catalogued as *Compendium Salernitanum* and attributed to Platearius, actually it is a version of the Latin *alphabetized Dioscorides.*[9] Similarly well embellished with illustrations (all but one of them in capital letters) is a fifteenth-century Aldobrandinus, *Le Régime de Santé* (*C.* 165). Most of the illustrated capitals depict *materia diaetetica* (i.e., food and drink), but there are also other health scenes such as blood letting, obstetrics, and medicines. Also semi-medical in character are six illustrated bestiaries; four of them bear the following titles: *Dicta Chrysostomi de naturis bestiarum,* early twelfth-century (*S.* 832); *Bestiarium optimum,* fourteenth-century (*S.* 890); *De natura bestiarum,* of about 1187 (*C.* 81); and a fourteenth-century Richard de Four-

[9] The typescript Library catalogue compares the manuscript to Sloane 4014, to Berlin, Hamilton, 407 and to Modena, Estense, 28. It also closely resembles a fifteenth-century Vatican manuscript (Chigi, F.VII.158) described in L. C. MacKinney, "Medical miniatures in medieval manuscripts of the Vatican Library," *Manuscripta,* 1959, 3, 3-18, 76-88.

nival, *Bestiare d'Amour* (*C.* and *S.* 459); the other two are thirteenth- and sixteenth-century Persian bestiaries by Ibn Bakhtishu (MSS. 500 and 790). These six bestiaries, which can be classified as materia medica only by reason of their descriptions of the medical uses of the animals pictured, portray little of actual medical practice. For example, there is more of folk lore than of medicine in the caladrius bird, shown perched on a patient's bed to prognosticate recovery (by looking at him) or death (by looking away); and the castor biting off its own testicles for the hunter to pick up illustrates a curious method of collecting materia medica. Similarly, semi-medical is Bonifacius Calabriensis' illustrated veterinary manual, in Italian, fifteenth century (*C.* 735).

Among the medical illustrations in non-medical manuscripts are the following: materia medica and anatomy (Adam and Eve) are found in Corbichon's fifteenth-century French version of Bartholomaeus Anglicus, *Livre des propriétés de choses* (*C.* 537); a spectacled rabbit-physician holds a urine flask and picks herbs while watched by two crippled dogs in a fifteenth-century book of hours (*C.* 358) (Fig. 1); something of surgery is represented in the circumcision of the Christ child (*S.* 868) and in St. Jerome extracting a thorn from a lion's paw (*S.* 491),[10] also there are zodiac-men, etc., in a calendar dated 1386 (*S.* 355) and in a fifteenth-century astrological manuscript (*C.* 384). The Morgan Library has relatively few unillustrated medical manuscripts; noteworthy examples are a Latin Dioscorides and a Macer herbal.

New York City has many private collections belonging to book dealers, physicians, etc., in which there are unillustrated medical manuscripts, and the same can be said for the Public Library and Columbia University. Outstanding among all these is the so-called "Cipher Manuscript" which belonged to the late Mrs. W. M. Voynich (*C.* 8); of uncertain date, late in the Middle Ages, it contains numerous drawings, some of them pharmaceutical. Another manuscript, from the fifteenth century, listed in William Schab's sales catalogue (30, item 117) has illustrations of temperaments, a man and woman bathing, and a zodiac-constellation figure with bleeding points and anatomical captions.

The YALE Medical Library, thanks to the generosity of Dr. Harvey Cushing and Dr. John Fulton, had a collection of medieval

[10] A similar miniature of Jerome and the lion appears as the frontispiece of a fifteenth-century German calendar in the Josiah C. Trent Collection of medical manuscripts and rare books at Duke University, Durham, North Carolina.

medical manuscripts comparable to any in America and to many in Europe even before the momentous acquisition (in 1955) of the famous Paneth Codex (*S.* 28).[11] This early fourteenth-century (1326) compendium of various aspects of medicine (even materia medica, diet, health regimes, *veterinaria* and the care of falcons) comprises treatises by 42 famous Greek, Graeco-Roman, Moslem, and Christian authors from Hippocrates to Macer and Roger (of Salernitan fame). It is neatly written on 1,378 pages, many of which are embellished with colorful miniatures (60 in all) of medical men and practices (Fig. 2), and numerous sketches of surgical instruments (inserted in the text). For quantity and quality of illustrations this manuscript compares favorably with the illustrated medical treasures of European collections, and in breadth of medical scope it surpasses many of them.

Of more restricted range is an illustrated fifteenth-century manuscript entitled *Tres libri medicini ypocratis platonis et diascoridis* (Cushing[12] 23; *S.* 18). Despite the authors cited, this is a compilation of materia medica (herbal and animal) belonging to a well-known combination of treatises, the herbal of Pseudo-Apuleius, the animal remedies of Sextus Placitus Papiriensis, and the pseudo-Dioscorides *De herbis masculinis et femininis.* Almost all of the 174 pages contain colored illustrations of herbs or animals, often with additional figures some of which depict ailing humans for whom the remedy was intended.

Another fifteenth-century manuscript (Cushing 45; *C.* p. 952) containing Mesue, *Opera,* etc., has eight very small, brightly colored illustrations of physicians explaining their remedies. Similarly small are six illustrations of physicians at the beginnings of sections of a fourteenth-century Rhazes, *Almansor,* etc., (Cushing 51; *C.* p. 951). Several other manuscripts have one or two illustrations each but of mediocre medical interest. For example, there are illustrated capitals depicting men asleep in bed, or lying dead under a poisonous herb, or picking herbs, etc., in a thirteenth-century manuscript of Aristotle, *Physica* (Cushing, 4; *C.* p. 2299). In a Galenic commentary on the Aphorisms of Hippocrates, etc., dated about 1300 (*S.* 29), is a marginal sketch of a hand and a cup with the caption *ova.* A single sheet (*S.* 44) from a fifteenth-century manuscript has a full-page anatomical drawing with explanations in French concerning "les parties interieures." For

[11] For details see Karl Sudhoff, "Codex Fritz Paneth," in *Arch. Gesch. Math.,* 1929, *12,* 1-32; and "Notes and Queries," J. Hist. Med., 1955, *10,* 239.

[12] *The Harvey Cushing collection of books and manuscripts,* New York, 1943.

the late medieval period there is a sixteenth-century manuscript in English (*S.* 26) containing full- or half-page anatomical illustrations, a bloodletting figure, and small figures depicting the four temperaments. Another late, but noteworthy, item is the modern replica of the famous Stockholm scroll of John Arderne (Cushing MS 3) made for Dr. Cushing by a Scandinavian friend. It is a remarkable reproduction of the fourteenth-century orginal.

Similarly noteworthy, though late in origin are six seventeenth- or eighteenth-century Islamic copies of earlier manuscripts. Two of them, Abu Bekr on animals, plants, and stones and a "Treasury of Wisdom" concerning animals and herbs, contain typically colorful and daintily artistic illustrations of herbs and animals. Such illustrations are found in many modern Islamic manuscripts of zoological or botanical materia medica. One other late manuscript (Cushing, MS 13), comprising astrological and medical treatises, contains colorful illustrations of the constellations and (on the first six folios) anatomical sketches. The three remaining Islamic manuscripts are anatomical, two of them the famous "Mansur," the other anonymous. All contain colored illustrations of the well-known medieval squatting figures (Sudhoff's *Fünfbilderserie*), which recur often in late Islamic manuscripts, a number of which (as we shall see) are in American collections. As will be noted in our alphabetical list of texts, the Yale Medical Library also has an unusually large number of unillustrated medical manuscripts (Cushing, 4ff).

The Boston Medical Library, notable for its medical incunabula, also possesses a formidable collection of medical manuscripts, of which only three are illustrated. One of these, with an explicit date of 1390, containing treatises in Latin and English concerning medical remedies, uroscopy, the plague, health regimes, and medical astrology (Ballard 19;[13] *C.* 23), also has a zodiac man and two series of sketches of urine flasks, each color of significance. A single folio (Ballard 3; *S.* 26) from a fifteenth-century manuscript depicts a full-page bloodletting figure, with red-ink bleeding points and lines leading to marginal notes. A thirteenth-century manuscript of Constantinus Africanus' translation of Isaac Judaeus, *De febribus* (Ballard 31; C. 2) has an illustrated initial containing a portrait of the author. In a recent

[13] J. F. Ballard, *A catalogue of the medieval and renaissance manuscripts and incunabula in the Boston Medical Library*, Boston, 1944. The *Catalogue* erroneously lists the zodiac drawing as a "zodiacal blood-letting man"; It lacks the bloodletting points.

acquisition of fourteen manuscripts of uncertain origin there is one with sketches of surgical instruments.[14]

The Boston Public Library has four medical manuscripts, two of which are illustrated. In a fourteenth-century Rhazes, entitled *De aegritudinibus* (*C.* 26), eight capitals introducing the various sections of the treatise are embellished with small, neatly colored illustrations of physicians or patients. Another manuscript in Latin, French, and English, of about 1400, concerned with various occult sciences (*S.* 100) has, in addition to numerous astrological charts and a rotary, one full-page bloodletting figure of the usual type, with red-ink bleeding points and lines to marginal notes.

In the large collection of manuscripts at the Houghton Library, HARVARD University, are a number of unillustrated medical manuscripts, and, bound in a printed book (*S.* 24278.116*), five stray folios of medical notes, dated 1512, containing drawings of a skeleton and a bloodletting man.

At the University of VERMONT, in Burlington, on the shelves of the rare book room of the library, is an interesting pictorial herbal, written *c.* 1500 in Italian with no text, only captions. The 141 folios contain neatly drawn plants in bright water colors. Some are full-page pictures, other pages have as many as eight herbs. In rare cases the herbal sketches are embellished with additional figures: birds, mice, demons, humans picking herbs, dogs or serpents attacking humans, angels hovering over humans (pointing out herbal remedies), men defecating or urinating, a man eating a root, a woman nursing her newborn babe, a man dosing a horse with medicine, and two anthropomorphic figures of the famous male and female mandragora (Fig. 3). The original *Census* listing (2: 580.9 M 31.45716) has been changed to TR.F580M319 in the Library catalogue.

The famous Osler Library at McGill University Faculty of Medicine in MONTREAL resembles the Boston Medical Library in that it has only a few illustrated items in its large collection of medical manuscripts. Most noteworthy among the illustrated items is a fifteenth-century anonymous *Liber medicalis* (Osler[15] and C., 7579). Arranged according to ailments, the treatise is introduced by a small illustrated initial showing a surgeon trephining a patient. Throughout the text are inserts of surgical instruments, sketched in red and black, with appropriate captions,

[14] Dr. Henry Viets was so kind as to permit me to examine these uncatalogued items in his office.

[15] *Bibliotheca Osleriana*, Oxford, 1929.

e.g., "*forma hec . . .*" Following the *Liber medicalis* are treatises concerning the plague, poisons, and the zodiac. A fourteenth-century anonymous *De morbis* (Osler and *C.*, 7590), also arranged by ailments, has a number of minute urine flasks in margins opposite urine diagnoses in the text. The treatise ends with a short account of uroscopy. Another fourteenth-century manuscript, the *Antidotarium* of Nicolaus Salernitanus (in Italian), followed by two *Synonyma* (Osler and *C.*, 7628), has an introductory initial portraying a physician, presumably Nicolaus.

As in several other medical libraries (Yale, Kansas City, Stanford-Lane, and the National Library of Medicine), the Osler collection has several Islamic manuscripts. A thirteenth-century Arabic materia medica (Osler 7508) arranged alphabetically (but lacking the items from L to Z), is attributed to Al-Ghafiki of Cordova. Almost all of the 284 folios are neatly illustrated with herbs (over 300 in number), animals, and minerals; many of these are half-page illustrations. Two late manuscripts (seventeenth-nineteenth-centuries), one in Arabic, (Osler, 7785, 75) the other in Persian (Osler, 7785, 76), both given to the Library by the late Dr. Casey A. Wood, are versions of the "Mansur" thirteenth-century anatomy. Both manuscripts contain illustrations of the *fünfbilder* squatting figures (depicting veins, arteries, nerves, muscles, and bones), also additional figures of a pregnant woman.[16]

Leaving Canada and moving toward the Middle West, one finds at ROCHESTER, New York, an unusual private collection. In Dr. John A. Benjamin's remarkable urological library are a number of manuscripts containing medical material. Three of these are illustrated. A surgical miscellany in German, although dated 1580, is noteworthy because it has full-page illustrations of the famous wound man and zodiac man; also a half-page scene of uroscopy, and twenty colored urine flasks alongside the descriptions and diagnoses. In an earlier manuscript, an anonymous treatise on uroscopy, written in German at about 1350, are sixty-seven water-color sketches of urine flasks, with captions inserted in the text. (Fig. 4). The third of the illustrated manuscripts (*S.* 2),

[16] In 1930 John Beattie and H. E. MacDermot prepared a brochure, *Exhibition of the history of anatomical illustration*, Montreal, McGill University (reprinted on the occasion of the 1947 meeting of the American Association of Anatomists), which contains excellent brief descriptions of fünfbilder illustrations, not only from Osler MSS, but also from other sources, European and Oriental. See pp. 2-3, 15-16. Dr. O. C. Gruner believes that these squatting figures are "of Mongolian origin." Neither he nor other scholars I have questioned have any explanation for the vase-like embryos in the Persian manuscript (folios 33v, 44v). See, however, L. H. Wells's ideas in *J. Hist. Med.*, 1960, *15*, 61.

another medical miscellany, entitled *Fasciculus medicinae*, written in Bohemia at about 1450 contains six full-page drawings of blood-letting figures, and eight colored illustrations of urine flasks to illustrate the textual diagnoses. Dr. Benjamin's unillustrated manuscripts are concerned with materia medica, uroscopy, the pulse, diet, regimen, fractures, etc.

Libraries of the CHICAGO area are rich in medical incunabula and other rare medical works, but poor in medical manuscripts, and of these none is illustrated. Of some interest medically, however, are two private collections. Dr. Joseph H. Kiefer, urologist of the University of Illinois College of Medicine, has a collection of colored slides illustrating uroscopy (ancient, medieval and modern). Mr. and Mrs. Joel Spitz of Glencoe, in their remarkable art collection, have several beautifully illustrated fifteenth-century Books of Hours, one of which (*C.* 514) contains several full-page medical miniatures; *viz.*, Saints Cosmas and Damian holding pharmaceutical utensils, nurses caring for the newborn Christ child, and two persecutors forcibly removing Ste. Apolonia's teeth with hammer and tongs. This manuscript exemplifies the medical illustrations that are to be found in sumptuous religious manuscripts throughout the Western world. So attractive are these manuscripts to American collectors, and so numerous are they in public and private libraries, that one wonders how there can be any such treasurers left in the European lands of their origin.

Moving westward from Chicago, the searcher for medical manuscripts finds less of interest. However, the University of Minnesota has two short texts, and in the private library of Dr. Charles D. Humberd, at Barnard, Missouri, are seven unillustrated medical manuscripts. Another surprise is encountered in the Clendening Library of the History of Medicine at the University of Kansas Medical Center in KANSAS CITY. Here, we believe, are two of the most important of all American holdings of Islamic manuscripts of *fünfbilder* anatomical figures (already mentioned as items at the Yale and Osler libraries and the National Library of Medicine). One of the manuscripts, a seventeenth-century Persian copy of the "Mansur" thirteenth-century anatomical treatise, has full-page illustrations of the vein-, artery-, nerve-, muscle- and bone-men. Another, from eighteenth-century Persia, depicts the same five figures, in full-page pictures, with no accompanying text but with detailed captions. In addition there are illustrations of the

Fig. 1. A rabbit-physician and two dog-patients. From folio 20v of a fifteenth-century Book of Hours. (Courtesy of the J. Pierpont Morgan Library.)

Fig. 2. Physician letting blood at a patient's elbow. From page 107 of the early fourteenth-century Paneth Codex. (Courtesy of the Yale Medical Library.)

Fig. 3. Female mandragora (mandrake) plant uprooted by a dog; woman, angel, and scorpion in margin. From page 98 of an herbal of about 1500. (Courtesy of the University of Vermont Library.)

Fig. 4. Urine flasks. From folio 277 of a German manuscript of about 1350. (Courtesy of Dr. John A. Benjamin of Rochester, New York, and the Department of Medical Photography of the University of Rochester Medical Center.)

digestive system, a pregnant woman, a child-birth, and a physician taking a woman's pulse.[17]

The University of Oregon (at Eugene) has a remarkable (and unpublicized) collection of medieval Latin manuscripts, comprising classical, scholastic, and liturgical treatises dating from as early as the eleventh century. However, the only medical manuscript is a Macer Floridus herbal (*S.* 15), with no illustrations but neatly ornamented.

The SAN FRANCISCO and LOS ANGELES areas teem with dealers and collectors of manuscripts, and with collegiate and medical collections both public and private. As mentioned above for other regions, the number of Books of Hours and of late Islamic manuscripts is impressive. The Library of the University of California at Berkeley has no illustrated medical manuscripts, but an unillustrated Marbodus lapidary and a late medieval medical account book in Italian. The Sutro Library in San Francisco has an Aldobrandino 'health regimen' and a book of medical 'secreta,' both in Italian.

The Lane Medical Library of Stanford University, now at PALO ALTO, is another Islamic surprise, with over fifty of the typically late manuscript copies of Avicenna, etc. A card catalogue, compiled by an Arabic medical student, briefly describes the contents of each item. The Stanford University Library has no strictly medical manuscripts, but a fifteenth-century veterinary manual by Flavius Vegetius Renatus is embellished with a full-page frontispiece depicting a veterinarian holding a tube to a horse's nostril and, with his other hand, another tube or a probe to the horse's jaw, while his assistant holds the reins and a bowl.

Another surprise is to be found in an out-of-the-way library of beautiful architectural charm, at St. John's Seminary near

[17] The University of Kansas Library, at Lawrence, has an M.A. thesis by an Arabic medical student which contains a description of this manuscript and a translation of the captions. It does not, however, do justice to the four additional illustrations, nor to the literature and problems of the *Fünfbilderserie* in Western medieval manuscripts, in modern Islamic manuscripts, and in oriental manuscripts (which have not been explored thoroughly for similar illustrations). Sudhoff's suggestion that the *Fünfbilder may* have originated in Hellenistic Alexandria whence they spread eastward and westward, has been accepted by most recent commentators. This assumption is being put to the test of extant manuscript evidences by Mr. Boyd Hill of the University of North Carolina. American Islamists could contribute to a solution by mobilizing the evidence in American collections such as have been mentioned above. Karl Sudhoff and E. V. Cowdry have noted certain Tibetan sources. Ilza Veith and O. C. Gruner suggest Mongolian origins. There might be traces in Central and South American sources. Strangely enough, not one ancient Greek or Byzantine trace has been found to justify the assumption of Hellenistic-Alexandrian origin.

CAMARILLO. Here, among the many illustrated liturgical manuscripts of the Doheny collection, is a fifteenth-century Book of Hours, in Spanish (Doheny[18]; MS. 700); the Office of the Dead in this manuscript is illustrated with a marginal picture in grisaille of a cadaver with the abdomen open. Also at the Seminary is a fifteenth-century manuscript of Bartholomaeus Anglicus in Corbichon's French translation (*Des propriétés des choses*) (Doheny, op. cit., p. 3, MS 6809): therein are several illustrations; viz., a lecturer demonstrating human anatomy with a naked figure, another lecturer on maladies, a physician directing his assistant in digging for stones, and numerous trees and plants as embellishments for the sections on herbal materia medica.

Another surprise in the Los Angeles area is the private library of Robert B. Honeyman, near SAN JUAN CAPISTRANO. This remarkable collection of rare books, incunabula, and medieval manuscripts (25 in number) is rich in the history of science. However, it has one medieval manuscript containing medical material, a twelfth-thirteenth-century miscellany of astronomical, mathematical, and musical works (*S.*1, General Science 1); colored illustrations of the constellations embellish the section on astral influences on health.

The outstanding collection of illustrated manuscripts on the Pacific Coast is at the HUNTINGTON LIBRARY AND MUSEUM, in San Marino. Here one finds a wealth of beautiful manuscripts, notably Books of Hours, also several medical manuscripts. An herbal leech book (MS. 19079) written in English "in the year of Christ 1100," has one marginal sketch of an herb. A fifteenth-century medical miscellany in Latin (*C.* HM 64) has the traditional bloodletting man, also two zodiac-men (*homo signorum*), the traditional sphere of Pythagoras, and eighteen rough sketches of urine flasks with instructions in English alongside. Less directly related to medicine are the following illustrations: Ste. Apolonia and her brutally extracted teeth are depicted in a Book of Hours (*C.* HM 1171); a thirteenth-century Aristotle, *De naturis animalium* (*C.* HM 1035) shows a monk explaining the nature of six animals standing nearby; a fourteenth-century manuscript containing Isidore's *Origines* and several histories (*C.* HM 1034), and a fourteenth-century Latin chronicle in scroll form (*C.* HM 264), depict the Creation and various other

[18] *A catalogue of books and manuscripts in the Estelle Doheny collection* (Los Angeles, 1955), pt. 3, p. 3.

historical scenes. The Library has several unillustrated medical manuscripts.

As compared with the East, the South (like the Middle and Far West) is a young region so far as manuscripts are concerned.[19] In DALLAS, Texas, Dr. Lyle M. Sellers' library has several unillustrated manuscripts, notably a fifteenth-century Hebrew version of Bernardus de Gordonio, *Lilium medicinae*; and the Burbank Collection of the Texas Medical Center in HOUSTON has a manuscript of a portion of Paul of Aegina. The most impressive collection of medieval medical manuscripts in the South is in the Reynolds Library, recently transferred to the University of Alabama Medical Center (at BIRMINGHAM) from its former home in Detroit. This collection has seven medical manuscripts, two of which are illustrated. The more noteworthy of these is a fourteenth-century manuscript (*S.* 4) containing Arnaldus de Villanova, *Regimen sanitatis* (along with other treatises); in it are twenty-six color drawings of people eating, drinking, and in maniacal frenzy; also a woman sitting on the bed of a sick old man, and numerous sketches of plants, trees, and fruits. Another manuscript, a fifteenth-century Hebrew translation of Rhazes, *Almansor* (book IX) has ornamental initials, and (at the beginning of a section on sex), a man and woman standing under a sort of canopy. The unillustrated manuscripts of the collection contain prescriptions, treatises on diseases, surgery, urinalysis, the pulse, and bloodletting; included are works by Bernardus de Gordonio and an unidentified Syriac treatise.

The somewhat sparse findings of manuscripts in the Middle and Far West impel us to remind readers that the total number of illustrated manuscripts in the United States and Canada is over 80. The number of separate medical miniatures is surprising; if each separate illustration of materia medica, surgical instruments, urine flasks, etc., is included, the total comes close to two thousand.

[19] It should be noted, however, that the medical libraries of these regions often have extensive collections of *modern* manuscripts concerning local physicians and medical practices of early American days.

B. Mediaeval Medical Treatises in North American Libraries[20]

THOMAS HERNDON

This check-list is composed of pre-sixteenth century medical treatises in public and private libraries in the United States and Canada. It is intended as a research tool for historians of medicine, science, and culture. As has already been indicated in the preceding section, in addition to strictly medical works, the list includes those of the ancillary disciplines of pharmacy, botany, etc. However, Islamic medical treatises are excluded.

Since there is no standard method of citing the names of authors, they are usually listed aphabetically in accordance with the citations in the *Census*. Anonymous treatises are listed alphabetically in a separate section. The information for a treatise is generally as follows: author's name; title; language of the treatise if different from that of the title; date as indicated in the reference; library symbol as found in the latest revised edition of the *Symbols Used in the National Union Catalog of the Library of Congress;* the name of the collection or owner if any; the local catalogue; the shelf-listing if known; the *Census* number; and, finally, the *Supplement* number. No numerical designation for a treatise means that it has not been entered in the *Census* or *Supplement.* A discussion of many of the works in this check-list may be found in the preceding section. The collaborators of this article will welcome any information concerning manuscripts that have not come to their notice.

AEGIDIUS CORBOLIENSIS, *De pulsibus:* 14c, CtY-M, *S.* 28;[21] 14-15c, MBM, Ballard 29, *S.* 31.

——, *De urinis:* 14c, CtY-M, *S.* 28; 13c, NcD, Josiah C. Trent; 14-15c, MBM, Ballard 29, *S.* 31; 15c, MiU, *C.* 205; 13c, PBm, Phyllis Gordon, *S.* 88.

AFFLATICUS, JOHANNES (AFFLACIUS), *Liber auraeus:* 13c, NcD, Josiah C. Trent.

——, *De urinis:* 13c, MBM, Ballard 48, *S.* 35.

ALBERTUS, MAGISTER, *Medicina equorum:* 15c, ICU, *C.* 172.

ALBERTUS MAGNUS, *Aggregationis:* 15c, NRB (JA), Dr. John Benjamin, *S.* 5.

——, *De homine:* 15c, CaQMMO, Osler 7506: *C.* 7506: 15c, ICU, *C.* 2; 13c, MiU, *C.* 201.

——, *De lapidibus pretiosis:* in Italian, 14c, DLC, *C.* 130, *S.* 101.

——, *De natura rerum:* 15c, PP, John F. Lewis, *C.* 136.

20 This work was supported in part by the American Philosophical Society and the National Institutes of Health, U. S. Public Health Service. The encouragement and guidance of Kenan Professor Loren MacKinney is sincerely appreciated. The assistance of Miss Louise Hall and Mrs. Pattie McIntyre, reference librarians in the University of North Carolina, is gratefully acknowledged.

21 For a description of this and other treatises in the Yale Paneth manuscript, see Sudhoff (n. 11).

——, *Liber Alberti tresdecim herbarum . . . decem animalium:* 13c, CtY-M, *S.* 39.

——, *Secreta mulierum:* in German, 15c, MdBJ, *C.* 3.

ALBICH, SIEGMUND, *Regimen sanitatis:* 15c, DNLM, Schullian 491, *S.* 9.

ALBUCASIS, *Cirurgia:* 14c, CtY-M, *S.* 28; 14c, NNNAM, Dr. Elliott Hague.

——, *De cibis sanorum egrorum:* 15c, CtY-M, *S.* 48.

——, *Liber servitoris:* 15c, DNLM, Schullian 518, *S.* 33.

ALDOBRANDINO DA SIENA, *La fisicha della santa del chorpo del uomo:* 14c, C-S, *C.* 2; in French, 15c, NNPM, *C.* 165.

ALEXANDER (OF SPAIN?), *De quatuor complexionibus:* 15c, MnU, Librarian's report, 1959.

ALEXIUS AFFRICUS, *Compendium medicinae:* 14c, MH, *C.* p. 995.[22]

ALGUAZIR ABUALE ZOR, *De curatione lapidis:* 14c, CtY-M, Cushing 51, *C.* p. 951.

ALVREDUS DE SARASHEL, *De motu cordis:* 13c, MdBWA, *C.* 428.

AMBROSIUS DE BENASCO, *Ad plagas:* 15c, CtY-M, *S.* 13 .

APULEIUS MADAURENSIS, *Apologia:* 14c, IU, *C.* 7.

APULEIUS (PSEUDO), *Herbal:* in Latin, 15c, Cushing 23, *S.* 18.

ARDERNE, JOHN, *Opera chirurgica:* 14c, DNLM, *C.* 9, *S.* 9.

ARNALDUS DE VILLANOVA, *Aphorismi:* 15c, NNNAM, *C.* 2.

——, *De arte cognoscendi venena:* 15c, NNNAM, *C.* 4.

——, *De bonitate memoriae, De decoratione, Phlebotomia:* 15c, DNLM, Schullian 494, *S.* 15.

——, *De vinis:* 15c, DNLM, Schullian 494, *S.* 15; in German, 15c, PP, John F. Lewis, *C.* 169.

——, *De virtutibus benedictae quercus:* 15c, DNLM, Schullian 516, *S.* 31.

——, *Epistola ad Jacobum de Tolleto de maximo secreto medicinae:* 15c, New York City, Denis Duveen, *S.* DD 121.

——, *Regimen sanitatis:* 14c, AU-M, *S.* 4; 15c, New York City, Curt Bühler, *S.* 21; 14c, CtY-M, Cushing 6, *C.* p. 953; 14c, PPC, *C.* 5.

ARNOLDUS, *Examinando leprosos:* 15c, MBM, Ballard 30, *C.* 10.

AVENZOAR, *Trattato di fisica:* 15c, CtY-M, Cushing 10, *S.* 15.

AVERROES, *Liber qui colliget nominatur:* 14c, MdBWA, *C.* 411, *S.* 287.

AVICENNA, *Canon medicinae:* 13c, CtY-M, Cushing 11, *C.* p. 952; 14c, DLC, *C.* 69.8; 14c, DNLM, Schullian 495, *C.* 1; 15c, DNLM, Schullian 511, *C.* 2; 15c, Barnard, Mo., Dr. Charles Humberd, *C.* 10 and 13; in Hebrew, 15c, MBM, Ballard 10 and 11; 14c, MBM, Ballard 12; 15c, NNNAM, *C.* 9; 14c, NNNAM, *C.* 10; 14c, PBm, *S.* 4.

——, *Cordiac:* in Hebrew, 15c, MBM, Ballard 13.

——, On fevers: in Spanish, 15c, MBM, *S.* 35.

B. DE FLORATA, *Flebotomia:* 13c, NcD. Josiah C. Trent.

BARTHOLOMAEUS, Short medical excerpts: in Latin, 13c, MBM, Ballard 48, *S.* 35.

BARTHOLOMAEUS ANGLICUS, *De proprietatibus rerum:* in French, 15c, CCamarSJ, Estelle Doheny MS 6809, *S.* 63; 15c, DLC, *C.* 129; 14c, DNLM, Schullian 496, *C.* 7; 14c, MBM, Ballard 15, *C.* 17; 14c, MH, *C.* pp. 994 and 1009; in English, 15c, NNC, George Plimpton, *C.* 263; 14c, NNNAM, *C.* 8; in English, 15c, NNPM, *S.* 875; in French, 15c, NNPM, *C.* 537.

BARTHOLOMAEUS DE MONTAGNANA, *Antidotarium:* 15c, CtY-M, *S.* 48.

BARTHOLOMAEUS SALERNITANUS, *Practica:* in Latin and German, 15c, NRB (JA), Dr. John Benjamin, *S.* 4.

BAYLEY, WALTER, *On the Preservation of Eyesight:* 15c, DFo, *C.* 294.1.

BERNARDUS DE GORDONIO, *De conservatione vitae humanae:* 14c, AU-M, *S.* 3; 14c, NNNAM.

——, *Lilium medicinae:* 14c, DNLM, Schullian 497, *S.* 15; 15c, DNLM. Schullian 498, *S.* 16; 15c, DNLM, Schullian 507, *S.* 25; in Hebrew, 15c, MBM, Ballard

[22] See also W. J. Wilson, "Catalogue of Latin and vernacular alchemical manuscripts in the United States and Canada," *Osiris*, 1939, *6*, 303.

16; 14c, PPC, *C.* 7 (formerly Osler 7523); in Hebrew, 15c, Dallas, Texas, Dr. Lyle Sellers, *S.* 8.

——, *De phlebotomia:* in Hebrew, 15c, MBM, Ballard 16.

——, *De prognosticis:* in Hebrew, 15c, MBM, Ballard 17.

——, *Tabula ingeniorum:* 13-15c, MBM, Ballard 18, *C.* 24.

BERTRUCIUS, NICOLAUS, *Practica chirurgiae:* 15c, NjP, Robert Garrett, *C.* 100.

BLUNDELL, RICHARD, *On Short Breathing:* 15c, DFo, *C.* 294.1.

BONIFACIUS CALABRIENSIS, *Libro de la menescalcia:* 15c, NNPM, *C.* 735, *S.* 735.

BRUNO LONGOBURGENSIS, *Chirurgia magna:* 14c, CtY-M, *S.* 28; 14c, DLC, *C.* 97, *S.* 69; 14c, DNLM, Schullian 499, *S.* 17.

——, *Chirurgia minor:* 14c, CtY-M, *S.* 28; 15c, DNLM, *S.* 74.

BURKHARD VON HORNECK, *Introductorium, De senectute conservanda:* 15c, DNLM, Schullian 500, *S.* 18.

CAELIUS AURELIANUS, *Gynaecia:* 13c, NNNAM.

CANCELLARIUS, *Experimenta:* 13-15c, MBM, Ballard 18, *C.* 24.

CELSUS, *De medicina:* in Italian, 15c, CaQMMO, Osler 305, *C.* 305.

CLEOPATRA, *Gynaecia:* 15c, DNLM, Schullian 518, *S.* 33; 13c, NNNAM.

CONSTANTINUS CASINENSIS (AFRICANUS), *De chirurgiis;* 12c, DNLM, *C.* 8.

——, *De natura humana:* 15c, MB, *C.* 26 and p. 2297.

——, *De stomacho:* 13c, MBM, Ballard 32, *C.* 1.

——, *Practica Pantegni:* 13c, CtY-M, Cushing 18, *C* pp. 951 and 2298; 13c, NcD, Josiah C. Trent.

——, *Viaticus:* 13c, CaQMMO, Osler 7626, *C.* 7626; 12c, CtY-M, Cushing 19, *S.* 16; 13c, DNLM, *C.* 11, *S.* 11 and *C.* 12, *S.* 12; 13c, MBM, Ballard 21, *C.* 15; 13c, PPC, *C.* 8.

COPHO, *De modo medendi:* 14c, DNLM, Schullian 521, *S.* 36; 13c, MBM, Ballard 48, *S.* 35.

CORDONE DI PAVIA, *Pratticola:* in Hebrew, 15c, MBM, Ballard 22.

DANIEL, HENRY, *Liber uricrisiarum:* in English, 15c, CSmH, *C.* HM 505; in English, 15c, MHi, *C.* 1.

DANCUS, *Ysagoge de falconibus:* 14c, CtY-M, *S.* 28; in Italian, 14c, DLC, *C.* 130.

DIETERICH, BERNHARDUS, *Artzatt buch gross practica:* 15c, AU-M, *S.* 5.

DINO DEL GARBO, *De emplastris et unguentis:* 14c, DNLM, Schullian 501, *S.* 19.

DIOSCORIDES, *Materia medica:* in Greek, 15c, CtY-M, *S.* 31; in Greek, 15c, MBM, Ballard 736, *S.* 39; in Greek, 10c, NNPM, *C.* 652, *S.* 652; 12c, NNPM, *C.* 760, *S.* 760, 14c, NNPM, *S.* 873.

DIOSCORIDES (PSEUDO), *De herbis masculinis et femininis:* 15c, CtY-M, Cushing 23, *S.* 18.

DOMINICI, DOMINICO, *De decimis non exigendis:* 15c, DNLM, Schullian 502, *S.* 20.

ELISHA, Key to medicine: in Hebrew, 14-15c, MBM, Ballard 23.

EUTEKNIOS, Paraphrase of Nikander's Theriaca and Alexipharmaca: in Greek, 14c, NNPM.

FERRARI DA GRADO, GIOVANNI MATTEO, *Consilium:* 15c, CaQMMO, Osler 7555, *C.* 7555.

FLAVIUS VEGETIUS RENATUS, Veterinary manual: in Greek, 15c, CSt.

FRANCISCUS DE PEDEMONTIUM, *Supplementum Mesue:* 15c, CaQMMO, Osler 7611, C. 7611; 15c, Barnard, Mo., Dr. Charles Humberd, *C.* p. 2311.

FRANCISCUS DE SENIS, *De natura balneorum:* 14-15c, NNNAM, *C.* 4.

GALEAZZO DI SANTI SOFIA, *De febribus:* 15c, DNLM, Schullian 504, *S.* 22.

GALENUS, *Antibalomenon:* 12c, DNLM, *C.* 8; in French, 13c, NjP, Robert Garrett, *C.* 131; 13c, MBM, Ballard 48, *S.* 35.

——, Antidotes and theriacs: in Greek, 15c, CtY-M, *S.* 37.

——, *De accidente et morbo, De complexionibus, De lapide, De malicia complexionibus, De pharmaciis, De pharmaciis Hippocratis, De phlebotomia,*

De regimine sanitatis, De utilitate anhelitus, De virtutibus naturalibus, Liber therapeutices; 14c, Cushing 32, *C.* p. 952.

——, *De alimentis, De complexionibus, De critis diebus, De differentiis febrium, De elementis, De interioribus, De juvamentis membrorum, De malitia complexionis diversae, De medendis febribus ad Glauconem, De regimine sanitatis, De simplicibus:* 13c, CtY-M, Cushing 31, *C.* p. 952.

——, *Meats and drinks:* 15c, CSmH, *C.* HM 64.

——, *De medicinis experimentatis:* 14c, CtY-M, Cushing 51, *C.* p. 951; 14c, CtY-M, *S.* 28.

——, *De pulsu et urinis:* 12c, DNLM, *C.* 8.

——, *De regimine sanitatis:* 15c, CSmH, *C.* HM 48.

——, *De virtute centaureae:* 15c, DNLM, Schullian 525, *S.* 40.

——, *Tegni:* 13c, CtY-M, *S.* 29; 14c, CtY-M, *S.* 28; 15c, CtY-M ,Cushing 44, *S.* 13; 15c, DNLM, Schullian 511, *C.* 2.

GAZIUS, ANTONIUS, *De proprietatibus jejunii:* 15c, MBM, Ballard 26, *C.* 3.

GENTILE DA FOLIGNO, *De hernia:* 15c, DNLM, Schullian 516, *S.* 31.

GIRARD DE BERRY, *Super viatico Constantini:* 13c, DNLM, Schullian 505, *C.* 11 and p. 2288, *S.* 23.

GIL DE PORTUGAL, *Medicina:* in Italian, 15c, DNLM, Schullian 506, *S.* 24.

GILBERTUS ANGLICUS, *De aegritudinibus aurium:* 14c, NRU-M, *C.* 1.

——, *Compendium medicinae:* 13-14c, CtY-M, Cushing 33, *S.* 19.

GIOVANNI DA PERGOLA, *Practica:* 15c, DNLM, Schullian 507, *S.* 25.

GIRALDUS, *Summa:* 14c, CtY-M, *S.* 28; 13c, MBM, Ballard 48, *S.* 35.

GOFFREDUS DE TRANO, Prescriptions for sore eyes: in Latin, 13c, CtY, *S.* 36.

GUAINERIO, ANTONIO, *Antidotarium, De balneis:* 15c, DNLM, Schullian 508, *S.* 26.

——, *Preservatio a peste:* 15c, CtY-M, *S.* 13.

——, *De venenis:* in Italian, 15c, CtY-M, *S.* 41

GUILLELMUS DE LANICEA EQUITANICUS, *Via vel dieta salutis:* 14c, NNC, David E. Smith, *C.* 13.

GUILLELMUS FALCONERIUS, *De falconibus:* 14c, CtY-M, *S.* 28.

GUILLERMUS PARMENSIS, *Chirurgia:* 15c, NNNAM, *C.* 4.

GUILLERMUS SALICETO, *Cirurgia:* in Italian, 14c, NNNAM, *C.* 4.

GUY DE CHAULIAC, *Chirurgia:* 15c, DNLM, Schullian 509, *S.* 25; in English, 15c, NNNAM, *C.* 12.

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HIPPOCRATES, *Alia secreta:* 14c, CtY-M, *S.* 28.

——, *Aphorismi:* 14c, CtY-M, *S.* 28; 13c, CtY-M, *S.* 29; 12c, DNLM, *C.* 8; 15c, DNLM, Schullian 510, *S.* 28 and Schullian 511, *C.* 2; 13c, NNNAM, *C.* 7; 13c, NcU, Loren MacKinney, *S.* 3.

——, *De aqua et aere:* 14c, CtY-M, *S.* 28.

——, *De epidemiae:* 14-15c, MBM, Ballard 29, *S.* 31.

——, *De regimine acutorum morborum:* 14c, CtY-M, *S.* 28; 13c, CtY-M, *S.* 29; 15c, DNLM, Schullian 511, *C.* 2.

——, *Diversa media:* 12c, DNLM, *C.* 8.

——, *Epistolae:* 15c, CtY-M, Cushing 35, *S.* 21.

——, *Excerpta:* 12c, DNLM, *C.* 8.

——, *Libro de la cure de cavalli:* 14c, MBM, Ballard 28, *C.* 14.

——, *Prognostica:* 14c, CtY-M, *S.* 28; 13c, CtY-M, *S.* 29; 15c, DNLM, Schullian 510, *S.* 28 and Schullian 511, *C.* 2; 14-15c, MBM, Ballard 29, *S.* 31.

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HUGO DE HEYDELBERGA, JOHANNES, *Compendium medicinale:* 15c, MBM, Ballard 30, *C.* 10.

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IBN AL-JAZZAR, *Epistula Ameti:* 14c, CtY-M, *S.* 28.

——, *Viaticum peregrinantium:* 13c, MdBJ, *C.* p. 2288.

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ISAAC JUDAEUS, *Diete universales et particulares:* 13c, CaQMMO, Osler 7626, *C.* 7626.

——, *De febribus:* 13c, MBM, Ballard 31, *C.* 2.

——, *De gradibus simplicium:* 13c, MBM, Ballard 738, *S.* 40.

——, *De urinis:* 13c, MBM, Ballard 48, *S.* 35.

——, *Liber dietarum particularium:* 14c, CtY-M, *S.* 28.

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JOHANNES DE SANCTO AMANDO, *Super quintum febrem:* 14c, CaOTA, *C.* 1.

JOHANNES DE SANCTO PAULO, *Breviarium:* 13c, CaQMMO, Osler 7626, *C.* 7626; 13c, DNLM, Schullian 511.1.

——, *De carnibus:* 13c, MBM, Ballard 21, *C.* 15.

——, *La Force des herbes:* 13c, NjP, Robert Garrett, *C.* 131.

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KANUTUS, *Regimen pestilentiae:* 15c, MH, *C.* p. 1010.

LIDGATE, JOHN, *Diatorie:* 15c, CSmH, *C.* HM 183; 15c, DNLM, Schullian 514, *C.* 4.

LULLUS, RAYMUNDUS, *De aquis medicinalibus:* 15c, New York City, Denis Duveen, *S.* DD 124.

MACER FLORIDUS, *De virtutibus herbarum:* 14c, CaQMMO, Osler 7587, *C.* 7587; 14c, CtY-M, *S.* 28; 14c, MBM, Ballard 35, *S.* 32; 13c, NNNAM, *C.* 11; 12c, NNPM, *S.* 863; 15c, OrU, *S.* 15; 15c, PPC, *C.* 3.

MAGNINUS DE MAGNIS, *Regimen sanitatis:* 15c, DNLM, Schullian 513, *S.* 29; 15c, NcD, Josiah C. Trent.

MARBODUS, *De lapidibus:* 14c, CtY-M, *S.* 28; 13c, CU, *S.* 31 nd 48; 15c, New York City, Denis Duveen, *S.* DD 101; 13c, MBM, Ballard 32, *C.* 1.

MARCHALL, ROGER, *Lanterne of fisicians:* 15c, NNNAM, *S.* 13.

MARSILIO DI SANTA SOFIA, *Contra album fluxum menstruorum:* 15c, DNLM, Schullian 518, *S.* 33.

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——, *Opera:* 15c, CtY-M, Cushing 45, *C.* 3.

MICHAEL SCOTUS, *La division del tempo:* 14c, MBM, Ballard 38, *C.* 21.

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NICOLAUS POLONUS, *Experimenta:* in Italian, 14c, DLC, *C.* 130, *S.* 101; in Latin and Czech, 15c, NRB (JA), Dr. John Benjamin, *S.* 2.

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PETRUS DE CIPERIA, *De oculo morali:* 14c, MBM, Ballard 41.

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——, *Thesaurus pauperum:* 13c, CtY-M, *S.* 39; in Italian, 14c, DLC, *C.* 130, *S.* 101; 13c, MBM, Ballard 18, *C.* 24; in Italian, 15c, MBM, Ballard 42, *C.* 5.

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PLATEARIUS, JOHANNES, *Practica brevis:* 13c, NN, Phyllis Goodhart Gordon, *S.* 89.

PLATEARIUS, MATHAEUS, *De simplicibus* (also called *Circa instans):* 14c, CtY-M, *S.* 28; in French, 13c, NjP, Robert Garrett, *C.* 131.

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R. DE APIEMUS "APIENTIS," *De cura sterilitati mulierum:* 15c, PPC, *C.* 2.

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——, *De lapide:* 14c, CtY-M, Cushing 51, *C.* 2.

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——, *Liber divisionis, Liber juncturarum, Liber puerorum:* 14c, Cushing 51, *C.* 2; 14c, CtY-M, *S.* 28.

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[23] In the general groupings of herbals, medical calendars, medical prescriptions, and medical treatises are anonymous works of varying lengths with no specific titles. The language of the treatise is assumed to be Latin unless otherwise indicated.

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Quod liceat pestilentiam fugere: 15c, DNLM, Schullian 502, *S.* 20.

Quoniam de cirurgia tracturi sumus: 14c, MBM, Ballard 38, *C.* 21.

Recepta varia: 15c, DNLM, *C.* 4.

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Theorica est perfecta noticia rerum: 13c, CaQMMO, Osler 7627, *C.* 7627.

Theriaca magna Galeni: 14c, CtY-M, *S.* 43.

Tractatus aquarum: 13c, NcD, Josiah C. Trent.

Tractatus medicus: 13c, PP, John F. Lewis, *C.* 283; 12c, Barnard, Mo., Dr. Charles Humberd, *C.* 14; 13c, *Ibid.*, *C.* 20.

Tumors: in Greek, 14c, IU, *C.* 4.

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Versus ex Schola Salernitana: in Latin and English, 15c, CtY, David Wagstaff, *C.* 9.

Veterinary Prescriptions: in Latin and English, 15c, CtY, David Wagstaff, *C.* 9.

Virtues of herbs: 15c, CtY, David Wagstaff, *C.* 9.

Virtutes efficatie: 13c, CtY-M, *S.* 39.

Widder dye pistellencie: 15c, NRB(JA), Dr. John Benjamin, *S.* 4.

APOLLO FLAYING MARSYAS

An engraving bearing the initials M.F. and the date 1536. New Haven, Yale Medical Library, Clements C. Fry Collection.

Apollo was the Greek god of archery, prophecy, and music. Marsyas was a shepherd who played so sweetly on the flute that, vain of his skill, he challenged Apollo to a musical contest, Marsyas to play on the flute and Apollo on the lyre. The god of course triumphed, and Marsyas was tied up to a pine tree and flayed alive by the victorious Apollo.

This engraving portrays Apollo holding the flaying knife in his left hand and the skin of Marsyas in his right, while the figure of Marsyas, still suspended from the tree by a rope and with his flute lying beneath his right hand, is represented in great anatomical detail. The figures of Apollo and those who crowd around also represent careful anatomical study. The knowledge of anatomy which is demonstrated in this engraving is all the more remarkable if the date 1536 is correct, for it would then be pre-Vesalian.

However, it has been pointed out, first by Holländer, that the date 1536 may not be reliable (also that a reversal in position occurred during the reproduction of the copper plate, which would place the knife in Apollo's right hand and Marsyas' skin in his left.)[1] The possibility that 1536 is not correct and that the engraving is actually post-Vesalian has led to considerable controversy. The identity of "M.F." has never been established. Meyer and Wirt pointed out that the famous muscle-man in Valverde's Anatomy of 1556 appears in the same posture as that of Apollo in the engraving by M.F. and that the latter might therefore have been the source of Valverde's figure.[2] Most recent evidence, however, confirms that the date of 1536 is impossible, for Wells has reported an engraving identical in composition but reversed.[3] It bears a dedicatory inscription to Francesco de Medici, Grand Duke of Tuscany, dated 1581, and the initials M.M., taken to stand for Melchior Meier. It is pointed out that the anatomy of both engravings is certainly post-Vesalian and that the 1581 version must be earlier because it has various details that are misunderstood or slurred over in the M.F. version. He thus concludes that "the date 1536 on the M.F. engraving must be rejected as either deliberate falsification or merely an error, on the part of the engraver, perhaps for 1586."

T.W.T.

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Notes and Events

Edited by Dorothy M. Schullian*

Little Known English Versions of the PRAXIS *and* OBSERVATIONES *of Felix Platter***

In investigating the history of mental deficiency I have been led to the psychiatric writings of the Swiss physician Felix Platter [Plater, Platerus] (1536-1614). After a considerable search I have found that Platter's two most important systematic treatises exist in English translation. Since neither translation is common, and since the very existence of at least one of them is virtually unknown I should like to call attention to them.

Platter's major systematic treatise was his *Praxeos, seu de cognoscendis, praedicendis, praecavendis curandisque affectibus homini incommodantibus. Tractatus tres,* Basel, 1602-1608. A complete translation of this *Praxis* is to be found under the misleading title *A Golden Practice of Physick. In Five Books and Three Tomes. After a new, easie, and plain method; of knowing, foretelling, preventing, and curing, all diseases incident to the body of Man. . . .* By Felix Plater, R.W., Abdiah Cole, Nich. Culpeper, London, Peter Cole, 1662. This *Golden Practice* may be found in the National Library of Medicine and in the Cushing Collection at Yale. It is by no means unobtainable, but it has been "lost" in the *Index-Catalogue of the Library of the Surgeon-General's Office* because it is not listed by title under Platter. The listing under Platter (actually under Plater), in the Second Series, 1908, *13,* 472, consists of a cross reference which reads "*See, also,* Golden (A.) [*sic*] Practice of physick [etc.] fol. *London,* 1662."

The other important systematic treatise by Platter is his *Observationum in hominis affectibus . . . libri tres,* Basel, 1614. The *Observationes* is a collection of case histories and it supplements the *Praxis.* The chapters and sub-sections have the same order and titles as those of the *Praxis.* The English translation of this work is truly rare. No copy is listed in Wing's *Short-Title Catalogue* or in the printed catalogue of any major library. In London, in the summer of 1960, I made the following note: "But see Plater, Felix, Histories and Observations, 1664, Roy. Soc. Med. Lib." Where I obtained this reference I have no idea. Recently, through the good offices of Miss Gertrude Annan, Librarian of the New York Academy of Medicine,

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and the kindness of Mr. Philip Wade, Librarian of the Royal Society of Medicine, I received a microfilm of this work which indeed proves to be an English translation of Platter's *Observationes.* The title page reads, in part, *Platerus. Histories and Observations upon most diseases offending the Body and Mind; Hurt of Functions, Pain or Troubles and Infirmities: In Three Books. . .*, By Felix Plater, Nich. Culpeper, Abdiah Cole, London, Peter Cole, 1664.

In order to convey an impression of the reliability of the translations I will cite the Latin, a careful, literal, modern translation (by Dr. Walter Federn) and the old translation of the opening sentences of each work. First the *Praxis*:

Mentis imbecillitas dici potest, cum aliquis apprehensione seu ingenio, judicio vel ratione, memoriaque minus quam homo ingeniosus et industrius valet. Quod aliquando in morbis accidit: alias vero non aegrotantibus, sed alioquin sanis euenit, de quo hic agemus.

Weakness of the mind it can be called when someone is less strong in apprehension or intelligence, judgment or reason, and memory, than an intelligent and industrious person. This is occasionally the case in diseases; at other times, however, it is to persons who are not sick, but otherwise healthy, that that happens of which we shall treat here.

A Weakness of the Minde may be said to be, whenas any one is less able in Apprehension or Wit, in Judgment or Reason and Memory, then an ingenious and industrious Man. Which somtimes happens in Diseases, at other times befals those that are not Sick, but otherwise Well, of which we will here Treat.

It can be seen that the translation of 1662 is a sound and accurate one, at least in these opening lines; the *Golden Practice* may therefore be used with some confidence as a guide to the *Praxis.* Unfortunately the same cannot be said for the *Observations*:

Ingenio hebeti & tardo natura, citra alium apparentem affectum, quamplurimos praeditos esse, atque uti dicunt, ingenio carere, cum omnibus sit notum, multis exemplis illud demonstrare, non est necesse, sed praecipua tantum attingere, suffecerit.

In infantibus mox haec ingenii hebetudo, cum educantur, & ad aliqua addiscenda coguntur, elucescit, & praesertim quando legere docentur, cum non nisi longo multoque labore, elementa litterarum cognoscere, syllabas conjungere, ex illisque dictiones integras formare possint.

Since the fact that a great many persons are endowed with a dull and slow intelligence by nature, without another apparent affection, and as one says, lack intelligence, is generally known, it is not necessary to demonstrate it by many examples, but to touch only on the main points should be enough. In infants this dullness of the intelligence soon becomes evident, when they are educated, and are forced to learn some things, and especially [at the time] when they are taught to read, since only by long and much exertion can they recognize the [letters of the] alphabet, put syllables together, and form complete words from them.

It is not necessary to shew that many are naturally without Wit, without any apparent Disease, by many examples. I shall speak only of some few. When Children begin to learn to Read, it is first perceived; for some cannot know their Letters, or Spell without great difficulty. . . .

The translation, at least of the opening lines, is, to say the least, a rather breezy one, which could not be relied upon as a precise translation at all. On the other hand it does give a perfectly fair indication of the content of the original. I have not, of course, made extensive comparisons, but it seems likely that the *Golden Practice* is a rather careful translation of the *Praxis* and the *Histories and Observations* an overly free translation of the *Observations*. Each may, however, prove very useful to the reader who does not care to tackle Platter's Latin.

The relative rarity of the *Golden Practice* and the apparent great rarity of the *Histories and Observations* may be attributable to the intervention, in 1666, of the Fire of London. Both books are the work of a commercial translator and are printed in bad type on cheap paper by a commercial publisher. They are unsuited for reproduction in facsimile. The publisher enlivens the text of the *Histories and Observations* by inserting at the ends of chapters little homilies plugging his other publications. One such reads: "To cure all Diseases, Read my [Platter's] Golden Practice, Sennertus, Riverius, Riolanus, Bartholinus, Johnston, Veslingus, Fernelius, Rulandus, Sanctor, Cole, etc."

PAUL CRANEFIELD

New Light on the Medical Career of Rhazes•

Hitherto it has been accepted that Rhazes began to study medicine when he was in his thirties or forties. Evidence has now been found which shows that he devoted his youth to the pursuit of medical knowledge in the hospital of Baghdad.

In MS. Marsh 537 of the Bodleian Library there is a collection of recipes and treatments, which Rhazes calls "Hospital experiences"; it appears under the title: *Amongst what was written in Baghdad by Muhammad b. Zakariyya in his youth*. These elementary notes contain simple therapeutic information, written in a style quite unlike that of Rhazes the experienced physician. Rhazes had private notes which were published after his death under the title 'al-Ḥāwī.' These are characterised by a large number of quotations which the author borrowed from ancient and mediaeval works. He acknowledges the author of every quotation, often naming the precise work from which the extract is taken. Following this review of the opinions of others, he usually adds his own, confirming, amplifying, or refuting the authorities quoted. His own views are always distinguished by the word "mine" (Arabic "lt") preceding them.

• This note is a summary of the detailed account of my discovery of Rhazes' notes which was published in Arabic in the periodical *al-Machriq*, 1960, *54*, 168-177.

In the text found in MS. Marsh 537 the expression "mine" does not appear, and Rhazes makes no comments of his own. Instead, we find repeatedly before each treatment and recipe the word "they," probably referring to the opinions of senior physicians or of those who established the hospital tradition.

One example will suffice to show the difference between the style that Rhazes used as an experienced physician and these elementary notes. Discussing the treatment of injuries resulting from falls, his student notes say only:

For injuries due to falling on a part of the body, *they* administer blood-letting from the injured part.

In his book 'al-Manṣūrī,' which was written much later, he reveals the range of his own experience:

For injuries due to falling, blows on the head and on any part of the body. If a rider falls off his animal or if he gets kicked or receives similar injuries, it is best to let blood immediately from the side opposite to that which receives the injury. The patient should particularly abstain from meat and wine, and the site of the injury should be anointed and fomented with corroborant drugs. If the head be injured, blood-letting should be carried out through the cephalic vein and the head should be anointed with one part of vinegar mixed with three parts of oil of roses. Potions of pure julep should be given to the patient to drink and should also be applied as a liniment. Morning and evening meals should be restricted to barley water for three days, when safety will be assured.

The style of the text in MS. Marsh 537 suggests that when Rhazes was young, he was a medical student or a junior practitioner in the hospital of Baghdad. He collected notes for his own use and endeavoured to sum up recipes and treatments used by senior physicians in the hospital. It appears that these recipes and treatments might have been selected from a standard work or canon, "The hospital canon," which was probably a textbook at the disposal of the hospital physicians.

A. Z. ISKANDAR

XVIIIth International Congress of the History of Medicine

The XVIIIth International Congress of the History of Medicine will be held at Warsaw, Poland, 17-21 September 1962 and at Kraków 22-24 September. Foreign historians are invited to present general introductory papers on medicine and humanism through the centuries and on physicians who were outstanding writers or artists. The sessions at Kraków will deal with cultural relations in medicine between Poland and other countries. Attention is called to the fact that the Jagiellonian University at Kraków, which was founded in 1364, will soon celebrate its sixth centenary. Four sections of the Congress will meet each morning; afternoons will be partially

devoted to sightseeing and excursions. The President of the Congress is Prof. Dr. Stanislaw Konopka, Ul. Chocimska 22, Warsaw, Poland.

Medical History in Iran

An Iranian Society of the History of Science and Medicine has been established at Tehran. The president is Dr. Adham Aalamomolk, the secretary Dr. M. Nadjmabadi. Historians in this country join in extending congratulations and good wishes to the new group, which may be addressed at 47 Avenue de France, Tehran, Iran.

D. J. Davis Lecture

Dr. Percival Bailey, Distinguished Professor Emeritus of Neurology, Neurological Surgery and Clinical Psychiatry, delivered the annual D. J. Davis Memorial Lecture on Medical History on 18 April in the Medical-Dental-Pharmacy Building of the University of Illinois College of Medicine. His subject was "Effort for Mental Health in the State of Illinois." Dr. Bailey is Director of Research, Department of Mental Health, State of Illinois.

Historical Activity at Osmania Medical College

The Department of the History of Medicine at Osmania Medical College has published (Hyderabad, Andrha Pradesh, 1961) a mimeographed brochure of 24 leaves containing a report of its organization and activities for the period 1956-1961. The department stems from a recommendation made by Henry E. Sigerist; its director is Dr. D. V. Subba Reddy, and it includes a library, a museum, an archival collection, an art section, and a photography section. Its teaching program covers both undergraduate and postgraduate work and also the training of teachers, its research program both purely academic research and applied or utilitarian research. The staff has grown in number since 1956 from 4 to 21, and an active program of publication is under way. The library will be grateful for reprints of articles on any phase of the history of medicine.

Acquisition of the Adelmann Collection by Cornell University Libraries

Dr. Stephen A. McCarthy, Director, Cornell University Libraries, has announced the acquisition, for the History of Science Collections, of the embryological and anatomical library of Professor Howard B. Adelmann.

This collection of more than 4,500 items was assembled over a period of forty years. It documents the history of embryology from the sixth century B.C. to about the last quarter of the nineteenth century A.D. Lacking almost none of the monuments and containing, in fact, 201 of the 235 books listed in F. J. Cole's *Early Theories of Sexual Generation*, it includes five incunabula, more than a hundred volumes from the sixteenth century, more than five hundred from the seventeenth, many more

than five hundred from the eighteenth, and well over a thousand from the nineteenth. Present are, for example, the very copies of the embryological treatises of Fabricius of Aquapendente, Padua, 1604 and 1621, which were reproduced in the facsimile edition, with introduction, translation, and commentary, that the Cornell University Press published in 1942; present also are Marcello Malpighi's tracts, London, 1673 and 1675, which with Professor Adelmann's translation, commentary, appendixes, a biography of Malpighi, a history of the University of Bologna, and in reality a history of all embryology are now in press in a 3-volume folio edition (Journal, 1958, *13*, 97). In addition to the monuments and the later editions of them there is an abundance of the smaller and less glittering works and of the bibliographical tools and biographical treatises which make the collection a genuine *working* unit in the history of its specialty.

This is one of the working units in the histories of all the sciences which are now being organized at the Cornell University Libraries. Here among rich general resources it will be possible to study the history of any science in its interrelations with other sciences and with the humanities; here the History of Science Collections are no isolated entity but an integral part of an academic commonwealth.

The Device on the JOURNAL *Cover*

Some interest has been expressed in the device which appeared for the first time on the Journal's front cover in January 1962. It had been chosen initially from a book of printer's devices because of its pleasant design and because of the rather pertinent and symbolic "Anchora spei." The cut was made from the small one appearing in Claude Desainliens' *The Frenche Littelton. A most easie, perfect and absolute way to learne the Frenche tongue. Newly set forth by Claudius Hollyband,* 1579, and proved to be even more attractive than the rather rough woodcut in McKerrow. (Had we preferred a simpler cut, we would have found it in Timothy Bright's *Treatise of Melancholie,* 1586.) For various reasons it was thought better to remove the initials which appear sometimes (but not always) in the device.

This device with its "Anchor of Hope" belonged to Thomas Vautrollier whom W. R. LeFanu in his charming Presidential address to the Huguenot Society of London (its *Proceedings,* 1959, *20*, 12-15) described as "book-binder, editor, printer, publisher, and dealer in books, perhaps also his own typecutter and founder." As a refugee printer in London (his activities have been traced between October 1564 and July 1587) Vautrollier has been praised as "ranking far above most of his contemporaries for the beauty of his types and the excellence of his press-work."

We hope that the device of this versatile sixteenth century craftsman will prove a good omen for a twentieth century journal aspiring to similar standards.

M.E.S.

Book Reviews

RICHARD H. MEADE. *A History of Thoracic Surgery.* Springfield, Illinois, Charles C Thomas, 1961. xx, 933 pp., illus. $27.50.

Reviewed by JAMES B. D. MARK, *Instructor in Surgery, Yale University School of Medicine.*

A BOOK on medical history is not a novel, and a medical historian is not a novelist, but Richard H. Meade has done reasonably well in making *A History of Thoracic Surgery* readable as well as informative. He has covered the fields of pulmonary, esophageal, cardiac, and major vascular surgery in their historical aspects with the view of demonstrating the impact of history on present-day knowledge. Chapter XXVI on Surgery for Mitral Stenosis is particularly engaging and noteworthy from this aspect. After recounting the very early clinical and laboratory work with mitral valvular surgery, there is a detailed account of Souttar's first "modern" mitral valvulotomy by the still-popular finger fracture technique. Souttar was clearly a man born twenty years too soon. His clinical observation and surgical technique seem quite astute, but he was working at a time before the availability of the many present-day ancillary techniques and services that make cardiac surgery possible.

Dr. Meade has included two sections which add significantly to the interest and value of his book. One is a short chapter on the history of the national thoracic surgical societies and the other a chapter in which are found photographs and brief biographical sketches of many of the men who made significant contributions to the development of thoracic surgery. The historical information about the thoracic surgical societies in this country is the kind that comes only from an intimate knowledge of their genesis and the men who organized them.

The publishers have done a commendable job in putting this volume together. The legible print and good quality paper make for effortless reading. The author or his editors, however, have allowed errors in spelling, grammar, and punctuation to creep into the text too regularly to be overlooked.

It must be difficult to write history while that same history is being made. In many of its facets, thoracic surgery is still in an early stage of development. This is true particularly for open-heart surgery, and the author did not have the perspective of elapsed time in writing this section. Even with these problems in mind, the book remains an important one. References included with each chapter are valuable. Both the student and the physician with interest in thoracic surgery will find this book worthwhile.

THEOPHRASTUS VON HOHENHEIM GEN. PARACELSUS. Sämtliche Werke, Karl Sudhoff, Ed. *Registerband.* Martin Müller, Comp. and Robert Blaser, Ed. Einsiedeln, 1960. 281 pp. S.Fr. 60.

Reviewed by ERWIN H. ACKERKNECHT, *Director, Medizinhistorisches Institut, University of Zürich.*

PARACELSUS is eagerly studied these days by those who hope to find in mysticism protection against the onslaught of eastern "materialist" irrationalism as well as those who want to understand one of the most influential and controversial figures in medical history. The main tool for such studies is the 14-volume edition of Paracelsus' medical works by Karl Sudhoff, which appeared between 1929 and 1933. Probably all those who have had to work with this edition have sighed for an Index. They will be eternally grateful to the late Prof. Martin Mueller of Munich for compiling one during the nineteen forties and nineteen fifties with the help of his thesis candidates, to the Swiss Paracelsus Society for having sponsored its publication, and to Prof. Robert Blaser for having edited it. The index is immensely useful as it is. It is, on the other hand, uneven in its coverage and not comprehensive on many points, as evidenced by its relatively modest size. Those who look up a certain notion in the Index can hope to be guided towards several (often contradictory) Paracelsian views on the subject; yet most of the time they cannot be certain of having seen all of them. This is easily understood in view of the way this Index was compiled.

GEORGE ERNST STAHL. *Four Short Treatises.* B. H. Gottlieb, Tr. and Ed. Leipzig, Joh. Ambr. Barth, 1961. 88 pp., 6 illus. (Sudhoffs Klassiker der Medizin, vol. 36). D.M. 6.30.

Reviewed by ERWIN H. ACKERKNECHT, *Director, Medizinhistorisches Institut, University of Zürich.*

THERE are medical classics which one studies because of the great influence they once exerted. There are others one consults because in form and content they still make superb reading. The Halle clinician, G. E. Stahl (1659-1734), inventor of phlogiston and animism, belongs in the former category. In the first of the four short treatises, which Dr. Gottlieb has translated from the Latin into German, Stahl redemonstrates that passions influence the body. In the second he discusses how the actions of the physician should support the healing tendencies of nature. In the third he claims that organism is not mechanism, and in the fourth he discusses the deontological problem of how often the physician should visit the patient. The texts show that Stahl was not very original, and that he often replaced argument by invective. He was so important because he revived vitalism in the midst of a tremendous mechanist wave.

The translating and editing of Dr. Gottlieb is competent. Dr. Gottlieb is remembered still as the co-author of one of the most notorious Nazi publications in medical history (SS Hauptsturmführer B. H. Gottlieb and SS Obersturmführer Alexander Berg: *Das Antlitz des Germanischen Arztes in vier Jahrhunderten.* Berlin 1942). That he makes his 'comeback' in a series published in the Russian Zone is not without piquancy.

PAUL F. CLARK. *Pioneer Microbiologists of America.* Madison, Wisconsin The University of Wisconsin Press, 1961, xiv, 369 pp., 38 illus. $6.00.

Reviewed by HERALD R. COX, *Director, Viral and Rickettsial Research, Lederle Laboratories, Division of American Cyanamid Company, Pearl River, New York.*

ACCORDING to the author's definition, "early" in this book corresponds roughly to the Victorian era, ending with World War I "when the philosophies and optimistic dreams of that era, many of them, manifestly unfounded, were shattered by Mars and Moloch." The author states that he hopes to "catch something of the spirit and the achievements of the period, the exuberance, the atmosphere of inquiry, the conflict, the suspense, the difficulties, the frontier movement into the 'brave new world' with its immense importance in medicine, in public health, in agriculture, in the dairy and other industries, in the broad field of biology itself, and in the intimate life of each family." The story is carried beyond World War I only in a few instances to complete the histories of certain outstanding individuals and events which had their beginning before or during World War I.

Of the eighteen chapters, the first may be described as an extended preface and philosophical introduction to the beginnings of microbiology, and narrates the early concepts of the origins of life and disease, the rise of the idea of *contagium animatum,* the overthrow of the doctrine of spontaneous generation, the work of van Leeuwenhoek, de Graaf, Swammerdam, Hooke, and Grew in opening the "doors into the new world of microbiology." Chapter 2 briefly outlines the origin of the United States Marine Hospital Service and its growth into the presently existing Department of Health, Education and Welfare; it also deals briefly with the first specific preventive medicine practised in America, namely, the introduction of vaccination against smallpox by Cotton Mather and Zabdiel Boylston of Massachusetts. Chapter 3 outlines critical epidemiological studies carried out before the birth of bacteriology by such workers as Bretonneau on diphtheria, Panum on measles, Snow on Asiatic cholera, Budd on typhoid fever, Oliver Wendell Holmes and Semmelweis on puerperal fever as well as the work of several less known but keenly observing early American physicians such as Austin Flint, L. A. Stimson, Ely Van de Warke, and C. S. Caverly. Chapter 4 gives a good review of some of the great epidemics that occurred before the days of bacteriology—yellow fever, Asiatic cholera,

malaria, and tuberculosis. Chapter 5 sketches the development of medical education and public health especially along the Atlantic seaboard. The succeeding chapters discuss the Medical School at Johns Hopkins University with interesting accounts of such persons as William H. (Popsy) Welch, G. H. F. Nuttall, W. W. Ford, W. G. MacCallum, and Eugene L. Opie; the pioneers in microbiology in Massachusetts—William T. Sedgwick, Harry M. Clark, S. De M. Gage, Harold C. Ernst, and Theobald Smith; Rhode Island, Charles V. Chapin; microbiologists in Connecticut—H. W. Conn, Lea F. Rettger, and Charles-Edward A. Winslow. The same pattern in the following chapters concerns the work of pioneer microbiologists in the Midwest, the Rocky Mountain area, and the Pacific Coast.

The final section of the book entitled, *Perspective*, includes two chapters: the first of these describes the means of communication used by the early leaders in the field, starting with the American Philosophical Society which originated from Benjamin Franklin's Junto in 1743. In the final chapter entitled, "Epilogue – From a Laboratory Window" the author philosophizes and reflects "as a vantage point from which to scrutinize microbiology and some of the failures and successes of microbiologists." In this chapter the author gives the master-word in microbiology which is the same as Osler's "The Master-word in Medicine"—*work*.

The book is well written, is full of histories, documented papers, and character sketches, is illustrated with numerous excellent portraits, and represents a great amount of research by one who undoubtedly had much personal contact with and knowledge of those of whom he writes. It is also quite apparent that the author fully enjoyed the life he lived as a teaching and practising medical microbiologist. The book should be read by everyone interested in the history of the development of medical microbiology in the United States.

FELIX MARTI-IBANEZ. *A Prelude to Medical History*. New York, MD Publications, Inc., 1961. xix, 253 pp., $5.75.

Reviewed by GENEVIEVE MILLER, *Assistant Professor of Medical History, Western Reserve University School of Medicine; Research Associate in Medical History, Cleveland Medical Library.*

THE publisher's blurb about this book promises that "*A Prelude to Medical History* represents a novel approach to a total understanding of this most important facet of man's cultural heritage. Based on the lecture courses on the history of medicine given by the author at New York Medical College, this book converts the history of medicine into an inspiring saga. Weaving the evolution of medical ideas as related to the history of civilization into a brilliantly hued tapestry of words, the author leads the reader to a surprising new enjoyment of medical history." Also, disappointment was in store for one reader, at least, and I wonder for how many others.

This book raises the question of what is worth publishing. With so

many hundreds of books spewed from printing presses daily, we are literally inundated with printed words. Surely there must be selectivity in the process of producing as well as reading these books. The author, having stressed in his foreword the many hours spent in preparing his lectures upon which the present volume is based, gives two reasons for publishing: "the insistence of colleagues and friends who were unable to attend the original lectures and the wish that others may share with me the fruits of my efforts."

While I am certain that Dr. Martí-Ibáñez' lectures were dynamic and inspiring events for his student listeners, they unfortunately do not stimulate and inspire the reader in the same way. The repetition of words and phrases suggests that the taped record was not sufficiently revised, and the promised "magic of storytelling" of the blurb never appears. No one can deny that lecturing and writing are two different skills which require very different techniques to be successful. I don't believe that anyone who has read a stenographic record of a lecture he has given has failed to be embarrassed by seeing his spoken words. They are repetitious, ideas are not fully developed and tend to be episodic, exaggerations abound, there is a multiplicity of descriptive abjectives with little meaning, and the text is difficult to read because there are too many words. The content tends to be thin and fails to sustain the reader's interest.

Far superior popularizations of medical history are books like Victor Robinson's *Story of Medicine* and Henry E. Sigerist's *Great Doctors,* not simply because they are well written, but because their authors had an extensive knowledge of their field; for in spite of the "many hours of willing sacrifice" which Dr. Martí-Ibáñez says went into his lecture preparations, he is not thoroughly grounded in his subject. Because his account is secondhand it does not have any newness or freshness of outlook which might distinguish it. Thus one must still recommend that his sources rather than his book be read.

Because this "Prelude" does not pretend to be a serious scholarly work, it would be a waste of time to point out its numerous factual inaccuracies (e.g., p. 86: Larissa is *not* near Cos; p. 154: Cotton Mather did *not* introduce vaccination; p. 157: Lady Mary Wortley Montagu did *not* import "variolization" from China). Chiefly to be criticized within its own scope is its lack of balance; of a 194-page treatment of the history of medicine from prehistoric times to the present, primitive and ancient medicine occupy fully one half the book, discussion of the seventeenth century begins on page 144, and the nineteenth century is embraced by nine pages! An appended "Selective Medical and Historical Chronology" is a useful compilation of names, dates, medical and historical events which enable one to ascertain at a glance the scientific and historical milieu at any date. A list of Nobel Prize Laureates with their contributions and an index conclude the volume.

With the limitations outlined, to what audience can this book be recommended?

FRANCESCO REDI. *Consulti medici.* Torino, Boringhieri, 1958, 265 pp.

Reviewed by GEORGE MORA, *Medical Director of the Astor Home for Children, Rhinebeck, New York; Research Associate, Department of the History of Science and Medicine, Yale University School of Medicine.*

THE editor Paolo Boringhieri of Turin has become known for his re-editing of some basic works in the history of science. Famous works, not easily available to the student, such as Buffon's *Histoire Naturelle,* have been reprinted in recent years. Similarly, the scientific productions of authors who have acquired universal renown in the fields of literature, history, or philosophy, such as Voltaire's *Lettres anglaises* and Goethe's scientific papers, are presented in clear editions in Italian translation. Redi's *Consulti Medici* acquire a special importance in this group because, aside from their value in the history of medicine, they constitute also a literary piece. Francesco Redi (1626-1698), in fact, is one of the well-known representatives of the Florentine "Seicento" who succeeded in combining literature and science in harmonious unity. This tradition of thought began with Galileo and was continued by his disciples.

Redi himself is especially remembered for his *Esperienze intorno alla generazione degli insetti* (1668) and *Osservazioni intorno agli animali viventi* (1684) in which he appeared as an indefatigable researcher. There is in him, as in other contemporaries (Steno, Malpighi, Borelli), the ingenuity and the freshness of the investigator who moves in an area where only prejudices and the passively accepted authority of the ancients have thus far prevailed. It is impossible to expect, at this early stage of scientific investigation, a methodical approach to research. Rather, Redi's experiments give the impression of being motivated by his constant desire to verify or to deny tenacious and fantastic beliefs, such as those concerning the mechanism of action of the poisons of vipers or the assumed miraculous property of certain oriental stones. The court of the Medicis of Florence, at the service of whom Redi spent most of his life, mainly as chief physician and superintendent of the pharmacy, offered him ample material for scientific investigation. In fact, the policy of the Medicis of favoring the interchange of ideas and the contact among scientists from all over the world can best be followed in Redi's correspondence in which the elite of his contemporaries, Magalotti, Steno, Malpighi, and Boyle, are either represented or mentioned and appreciated.

It is in the artistic, serene, and progressive climate of the Florentine "Seicento," apparently limited to the Court of the Medicis and to their "Accademia del Cimento" but yet cosmopolitan, that Redi undertook his experiments. In spite of the fact that Latin was still at that time the common language of scientists, Redi reported his experiences in a concise, beautiful

Italian, by which he gained a permanent place in Italian literature. A well-versed linguist, Redi was among the few scholars selected to accomplish the ambitious design of establishing the correct Italian language in the "Vocabolario della Crusca." Perhaps, more than this, it is the freshness of his biological approach to science that made him prefer Italian to Latin, almost signifying the advantage of a younger and more flexible language to catch and describe the dynamics of biological phenomena.

Redi, in fact, remains essentially a biologist, even in these *Consulti*, written to be published as was customary at the time. Originally appearing in 1726 and 1729, the *Consulti* were successively printed as part of Redi's "Opera omnia" in 1742-1745, in 1781 and in 1809-1811, and, separately, in 1831 and 1863. Recent Redi anthologies have not included them, thus making the present edition even more timely. Many topics, covering various aspects of human pathology, are included so that it is difficult to mention them in detail. However, this difficulty is minimized by the fact that a few common themes run through the *Consulti*: a biological explanation of disease based on solid anatomical knowledge, a belief in the importance of a regular life and diet as a means of preventing and overcoming diseases, a preference for simple and natural medications rather than elaborate ingredients. Finally, Redi discouraged his patients from drinking wine, in spite of the fact that he himself had published a long poem *Bacco in Toscana* (1685) to praise the quality of the wines of Tuscany. This poem is, however, more than anything else, an expression of the ironic aspect of Redi's personality, of which there is frequent evidence in the *Consulti*.

The *Consulti* thus anticipated many views of neo-Hippocratic medicine and constitute, therefore, an important document in the history of medicine. Because of this orientation, Redi may be placed among the great representatives of seventeenth century medicine. His descriptions of some clinical syndromes, such as those of kidney stones (p. 33), of generalized edema (p. 49), of cardiac asthma (p. 141), of ischiatic pain (p. 157), as well as of the fetal cardiac circulation (p. 187), are masterpieces of clarity and elegance. It is a pity that any attempt to translate them into another language would cause them to lose the beauty of the original Italian. In his effort to be understood by his patients, Redi makes frequent use of colorful analogies and, in the spirit of the Hippocratic tradition, focuses on the patient rather than on the disease. In spite of his apparent lack of concern for psychological matters—obviously not to be expected in a seventeenth century writer, a feeling of sympathy for the patients permeates each page of the *Consulti*. It is this broad approach to the patient, together with a depth of scientific understanding of disease from a biological viewpoint, that makes the reading of Redi's *Consulti*, three centuries after their writing, a source of scientific as well as literary enjoyment.

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Early American Experiments on "Spontaneous Generation" by Jeffries Wyman (1814-1874)

RAYMOND N. DOETSCH*

It is generally acknowledged that the classical and definitive investigations of Pasteur, Tyndall, Lister, and other Europeans during the sixth and seventh decades of the nineteenth century resolved the controversy concerning the origin of microorganisms occurring in heated infusions. American investigators are usually not mentioned in this regard, and, indeed, the evidence of Richmond[1] indicates that the American attitude toward the germ theory of disease was one of neglect and almost complete disinterest until the post-Civil War period. In an exhaustive study, McClung[2] found that only thirteen textbooks, monographs, or addresses were published in the United States on what one would now be termed "microbiological antecedents," during the sixty-eight years (1794 to 1862) preceding the account described in the present paper. In general, these works dealt with the nature and possible etiology of diseases common at the time, such as diphtheria, malaria, and yellow fever. It seems clear from the evidence at hand that during the period 1850 to 1880, when European workers were exceedingly active in establishing the foundations of the modern science of microbiology, there was almost no experimental work in this area being carried on in America. The situation has been concisely summarized by Richmond.[3] "A glance at the etiological sections in American books and journals of these decades shows that the old miasmatic and atmospheric theories were still of paramount importance. The familiar explanations recur with monotonous regularity, involving miasmata, epidemic constitution, ozone, poisonous gases, and similar items." (See also Allen.[4])

It was, of course, necessary to resolve the question of the origin of microorganisms before any germ theory of disease could

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1 Richmond, Phyllis Allen. American attitudes toward the germ theory of disease (1860-1880). *J. Hist. Med.*, 1954, *9*, 428-454.

2 McClung, L. S. Early American publications relating to bacteriology. I. Textbooks, monographs, addresses, etc. *Bacteriol. Revs.*, 1944, *8*, 119-160.

3 *Loc. cit.* (n. 1).

4 Allen, Phyllis. Etiological theory in America prior to the Civil War. *J. Hist. Med.*, 1947, *2*, 492-498.

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be launched on a rational basis. Since there was an almost total lack of interest in this subject in the United States, it is all the more remarkable that at least one American carried out laboratory experiments on the "spontaneous generation" of microorganisms at approximately the same time that Pasteur was doing his monumental work in France. Reference is made to Jeffries Wyman and the experiments reported by him in two papers, the first published in 1862 and the second in 1867. It would perhaps be appropriate at this junction to observe here that the details of Wyman's career and life have been thoroughly documented, particularly by Oliver Wendell Holmes,[5] Asa Gray,[6] and A. S. Packard,[7] among others.[8]

In 1862 Wyman's first paper on the occurrence of organisms in heated infusions was published in the *American Journal of Science and Arts*.[9] The flasks used in this work are shown in Figure 2. Infused materials were sealed inside the one shown at the left with a cork containing a single glass tube driven deeply down the neck. This was firmly seated by covering with an adhesive cement consisting of resin, wax, and varnish. The glass tube was bent at a right angle, constricted, and then cemented with plaster of Paris to an iron tube containing numerous fine wires, thus leaving only narrow passage ways into the flask. In the center figure, the glass tube and cork were omitted, the flask neck itself being drawn out at a right angle, constricted, and again cemented directly to the wire-filled iron tube. The flask at the right was merely hermetically sealed. Thus the experimental arrangements were those previously employed by various investigators from Needham and Spallanzani to Pouchet and Pasteur. It is obvious, therefore, that Wyman was well aware of the developments in the field at the time he was doing this work.

The flasks ranged from 250 to 875 ml. capacity and generally contained from 17 to 50 ml. of infusion. A number of mixtures were examined including concoctions of sugar, gelatin, hay, pepper,

5 Holmes, O. W. Professor Jeffries Wyman. *Atlantic Monthly*, 1874, *34*, 611-623.

6 Gray, A. Remarks in relation to the death of the late president of the society, Prof. Jeffries Wyman. (An address given at a memorial meeting on 7 October 1874) *Proc. Boston Soc. nat. Hist.*, 1875, *17*, 96-124.

7 Packard, A. S. *Nat. Acad. Sci. Biog. Mem.*, 1878, *2*, 75-126.

8 Further details may be read in T. F. Harington's. *The Harvard Medical School*, New York, 1905, 2, pp. 815-831; *A history of the first half-century of the National Academy of Sciences*. Washington, D. C., 1913, pp. 197-200; and B. G. Wilder's, Sketch of Dr. Jeffries Wyman, *Pop. Sci. Monthly*, 1875, *6*, 355-360.

9 Wyman, J. Experiments on the formation of infusoria in boiled solutions of organic matter, enclosed in hermetically sealed vessels, and supplied with pure air. *Amer. J. Sci.*, 1862, *2d. Ser. 34*, 79-87.

Fig. 1. Jeffries Wyman (1814-1874). (Courtesy of the National Library of Medicine.)

cheese, wine, milk, meat, meat juice and cabbage. The infusions were boiled for various periods of time, and in the case of experiments using flasks equipped with the iron tube, the latter was heated to redness while steam issued from it. The flasks then were allowed to cool very slowly so that all entering air traversed the heated iron tube. Finally the flasks were sealed off at the constriction with a blow-pipe, and incubated at 70° to 80° F.; the contents were then observed periodically for changes. The hermetically sealed flasks were submerged in boiling water for various periods of time, cooled and incubated as above.

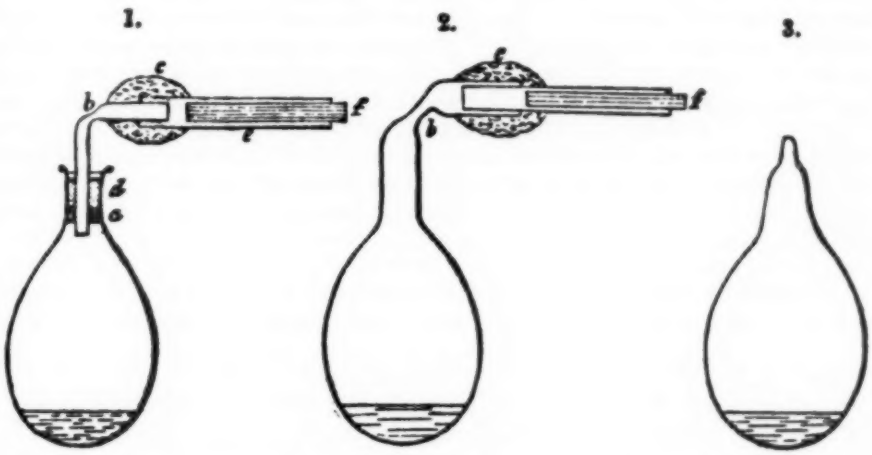

FIG. 2. Three experimental arrangements of flasks employed by Jeffries Wyman in his study on spontaneous generation (1862).

In all, Wyman reported on thirty-three experiments performed from 3 February to 28 March 1862. The results obtained indicated that regardless of the type of flask employed, or the nature of the infusion, or the duration and mode of heating (from boiling to exposure at five atmospheres pressure in a Papin digester), except in four instances, "Bacteriums, Vibrios, or other organisms appeared." The four negative results were obtained using flasks of the sort depicted at the left in Figure 2 with boiling exposures up to on hour and forty minutes. This work was of interest to some of his colleagues for he wrote that "Prof. Asa Gray witnessed the opening of some of these flasks and satisfied himself of the presence of Infusoria in the contents." Wyman concluded that "the boiled solutions of organic matter made use of, exposed only to air which had passed through tubes heated to redness, or enclosed with air in hermetically sealed vessels and exposed to boiling

water, became the seat of infusorial life."[10] However, he was extremely guarded in drawing conclusions and stated, "the experiments which have been described throw but little light on the immediate source from which the organisms in question have been derived." Further, in discussing these results he says:

> Those who reject the doctrine of spontaneous generation in any of the forms in which it has been brought forward, will ascribe them (i.e., the results of his experiments) to spores contained either in the air enclosed in the flask, or in the materials of the solution. Those who advocate the theory of spontaneous generation, on the other hand, will doubtless find, in the experiments here recorded, evidence in support of their views. . . . If, on the one hand, it is urged that all organisms, in so far as the early history of them is known, are derived from ova, and therefore from analogy, we must ascribe a similar origin to these minute beings whose early history we do not know, it may be urged with equal force on the other hand, that all ova and spores, in so far as we know anything about them, are destroyed by prolonged boiling: therefore, from analogy we are equally bound to infer that Vibrios, Bacterium, etc., could not have been derived from ova, since these would all have been destroyed by the conditions to which they have been subjected. The argument from analogy is as strong in the one case as in the other.[11]

Wyman's work attracted the notice of European workers, for in 1863 Milne-Edwards,[12] an advocate of Pasteur's views regarding spontaneous generation, questioned Wyman's results and suggested that there were strong possibilities of technical errors in it. In this regard Bulloch[13] has written:

> Watson-Cheyne and Tyndall have drawn attention to an exception which had probably an important bearing on the results [Wyman's]. Pasteur employed flasks of a capacity of 250 to 300 cc. and introduced into them 100 to 150 cc. of infusion. Wyman's flasks were of 500 to 800 cc. capacity and the amount of infusion was only 12 to 40 cc. In some of Wyman's earlier experiments the air content in the flask was more than 30 times that of the infusion. It may now be assumed that in Wyman's experiments a large part of the flask and its aerial contents were not adequately sterilized when he imagined they were.

It should be pointed out that Pasteur's experiments, especially many of those detailed in his 1862 memoir,[14] dealt largely with infusions composed of a ten per cent solution of sugar in yeast water. Undoubtedly this was more readily sterilized by boiling

[10] *Ibid.*, p. 86.

[11] *Ibid.*, pp. 86-87.

[12] Milne-Edwards, H. *Leçons sur la physiologie et l'anatomie comparée de l'homme et des animaux*. Paris, Masson, 1863, *8*, pp. 260, 269.

[13] Bulloch, W. *The history of bacteriology*. New York, Oxford University Press, 1938, 432 pp. See pp. 106-107.

[14] Pasteur, L. Mémoire sur les corpuscules organisés qui existent dans l'atmosphère. Examen de la doctrine des générations spontanées. *Ann. chim. Phys.*, 1862, *64*, 5-110.

than some of Wyman's infusions, and in this connection the great resistance of bacterial spores to heating was not grasped until their discovery by Cohn[15] in 1876, and from Tyndall's[16] remarkable work on the sterilization of hay infusions. (See also Roberts.[17])

After a lapse of five years Wyman published a second paper[18] entitled, "Observations and experiments on living organisms in heated water." After briefly referring to his 1862 results, he expressed a more definite view on the subject of spontaneous generation:

> There can therefore be no certainty of the existence of spontaneous generation in a given solution, until it can be shown, that this has been freed of all living organisms which it contained at the beginning of the experiment, and kept free of all such from without during the progress of it. On the other hand, this kind of generation becomes probable, whenever it is made certain that Infusoria do appear in solutions, in which the conditions just mentioned have been complied with. We say probable, because their appearance under such circumstances would not amount to a proof. The absolute proof of spontaneous generation must come from the formation of living organisms out of *inorganic* matter. If Infusoria are generated in solutions of organic matter, independently of spores or germs, the question may be fairly raised whether we do not begin the experiment with materials in which life already exists, even though this material is not in the form of distinct organisms.[19]

If I interpret this statement correctly, Wyman's position on spontaneous generation corresponded most closely to what Milne-Edwards designated as "agenetic" generation,[20] and to which Bastian[21] applied the term "archebiosis."

The purposes of the work described in Wyman's 1867 paper were in check on the accuracy of the 1862 results in the light of Milne-Edwards' criticisms and to determine "how far the life of certain kinds of low organisms is either sustained or destroyed in water which has been raised to a high temperature, a result which must be reached before spontaneous generation can be either asserted or denied."[22]

15 Cohn, F. Untersuchungen über Bacterien. *Beitr. Biol. Pflantzen*, 1876, 2 (part 2), 249-276.

16 Tyndall, J. Further researches on the deportment and vital persistence of putrefactive and infective organisms from a physical point of view. *Phil. Trans.*, 1878, *167*, 149-206.

17 Roberts, W. Studies on biogenesis. *Philos. Trans.*, 1874, *164*, 457-477.

18 Wyman, J. Observations and experiments on living organisms in heated water. *Amer. J. Sci., 2d. ser. 44*, 152-169.

19 *Ibid.*, p. 152.

20 *Ibid.*

21 Bastian, H. C. *The beginnings of life; being some account of the nature, modes of origin and transformation of lower organisms.* London, Macmillan, 1872, 2 vols., 475 pp., 640 pp. Wyman's results are quoted at length to support the theories on spontaneous generation advanced in this treatise.

22 *Loc. cit.* (n. 18), p. 153.

Wyman first examined the published evidence then available concerning the existence of organisms in thermal springs in various parts of the world and concluded that "in thermal waters plants belonging to the lower kinds of Algae live in water the temperature of which in some instances rises as high as 208°F."[23] He then returned to the experiments on boiled solutions of organic matter contained in sealed flasks and wrote that "they are in part repetitions of some of those formerly described, the results of which they fully confirm. Great pains have been taken to ensure accuracy in conducting, as well as in observing and recording them."[24]

After a series of five experiments on various infusions heated in flasks to which were attached a copper tube filled with fine wires, and in which all were found to contain organisms (a drawing included in the paper shows, among other fragments, bodies which are undoubtedly bacteria, containing endospores), Wyman changed his technique. He employed small flasks of 70 ml. capacity containing 5 to 8 ml. of infusion which were sealed by fusing the necks, and then submerged in boiling water for various periods of time. He stated that,

> this method corresponds substantially with that of Needham and Spallanzani. It is in all respects more simple and easier than that in which the apparatus is complicated with a heated tube. This last beyond a question destroys all organisms contained in the air which enter the flask through it, but is without effect on any such as may be contained in the solution, or adhere to the inner surface of the glass. These come in contact only with boiling water or steam, and unless destroyed by one or the other of these, would be sufficient to vitiate any experiment, however careful the adjustment and heating of the tube may have been. We therefore believe that the tube is an unnecessary and useless complication of the apparatus.[25]

Nine experiments performed in this manner revealed that, ". . . flasks hermetically sealed, and then immersed in boiling water for periods varying from a few minutes to four hours, also became the seat of infusorial life. The infusoria were chiefly Vibrios, Bacteriums and Monads."[26] However, it was found that "no infusoria of any kind appeared if the boiling was prolonged beyond a period of five hours."[27] The results of these experiments are remarkably similar to those obtained nearly ten years later by

[23] *Ibid.*, p. 169.
[24] *Ibid.*, p. 157.
[25] *Ibid.*, pp. 159-160.
[26] *Ibid.*, p. 169.
[27] *Ibid.*, p. 169.

Roberts[28] and Tyndall[29] in which it was also discovered that certain infusions could not be sterilized even when boiled for over five hours.

Finally, Wyman carried out some interesting experiments to determine the effect of water heated to high temperatures on living infusoria. In this work he studied the motility and reproduction of infusoria added to water from various fermenting materials. It was found that

> infusoria having the faculty of locomotion lost this when exposed in water to a temperature of from 120°—134° F. If Vibrios, Bacteriums, and Monads are added to a clear and limpid organic solution, this becomes turbid from their multiplication in from one to two days. If however they have been previously boiled, the solution does not become turbid, until from one to two days later, and in some of the experiments not sooner than does the same solution to which no infusoria have been added.[30]

Throughout this paper Wyman again clearly demonstrated that he was well aware of the work of Pasteur and others involved in the spontaneous generation controversy. He took Pouchet's[31] claim that there was a possibility infusoria might appear in boiled solutions exposed to pure air at its face value, but reiterated his position that "when flasks, holding organic fluids and air, are hermetically sealed and boiled for from fifteen minutes to three or four hours, and infusoria make their appearance nevertheless, the experiment cannot be called a faulty one, *so long as only these results are claimed*"[32] (my italics). I cannot refrain from pointing out that although some of Wyman's infusions may have been more difficult to sterilize by boiling than Pasteur's sugar-yeast extract solutions, he nevertheless persisted in using only *small* volumes of infusion in relation to flask capacity, i.e., approximately ten per cent of their total volume. Thus he did not really meet the objections of Watson-Cheyne and Tyndall alluded to previously in this connetcion.

I do not believe that anyone will claim that Wyman was a major, though unrecognized, figure in the spontaneous generation controversy. It seems noteworthy that in the America of this time he possessed sufficient curiosity and fortitude to attempt a study of this problem which was largely, if not exclusively, an epic of

28 *Ibid.*
29 *Ibid.*
30 *Ibid.*, p. 169.
31 Pouchet, F. A. *Nouvelles expériences sur la génération spontanée et la resistance vitale.* Paris, Masson, 1864, 256 pp.
32 *Loc. cit.* (n. 18), p. 157.

Western European science.[33] It is of interest to note that Wyman had followed the work of Darwin and had corresponded at some length with him,[34] and it may well be that, as suggested by Dupree,[35] "the inclusion of crystals in the evolutionary series gave him a reason for his experimenting carefully . . . on spontaneous generation." Dupree has further written[36] that "Wyman doubtless considered that these researches bore directly upon a crucial evolutionary problem." In any event, Wyman was not a "heterogenecist," even though his results paralleled some of Pouchet's, and despite the fact that the latter used Wyman's 1862 observations to support his views on heterogenesis, even to the point of including a drawing of the flask shown in the center of Figure 2. It should be pointed out that Pouchet did not necessarily fail (although Pasteur believed he did) to obtain sterile infusions after boiling them because of an inherently faulty technique, but rather from drawing wrong conclusions from results, many of which were probably obtained accurately. Wyman, on the other hand, deserves our admiration for not falling into Pouchet's logical errors, and in the two papers considered here he gives one the impression of taking great care in the execution, observation, and interpretation of his experiments. It is unfortunate that he did not see fit to further pursue this work, which, as mentioned above, antedated the brilliant contributions of Roberts and Tyndall by nearly a decade. However, Wyman's interests lay primarily in anatomy and in the development of the newly established Peabody Museum of American Archeology and Ethnology at Harvard College, and by 1867 the state of his health probably had declined to the point where these duties began to weigh heavily upon him.

Wyman deserves the notice of present-day microbiologists because he represents a lone figure in this area, and at this period, in American biology. Although he returned to the problem in 1867 only to defend himself against Milne-Edwards' charges, nevertheless his papers can be perused profitably by historians interested in tracing the antecedents of American microbiology.

33 See, for example, Bulloch (n. 13), pp. 67-119; and Doetsch, R. N. *Microbiology: historical contributions from 1776 to 1908.* New Brunswick, N. J., Rutgers University Press, 1960, 233 pp.

34 Dupree, A. H. Some letters from Charles Darwin to Jeffries Wyman. *Isis,* 1951, *42,* 104-110.

35 Dupree, A. H. Jeffries Wyman's view on evolution. *Isis,* 1963, *44,* 243-246.

36 *Ibid.*

Some Speculations on the Nature of Milton's Blindness

WM. B. HUNTER, JR.*

PHYSICIANS and students of literature have argued frequently about the nature of Milton's blindness. If we disregard such aberrations as the notion that it was caused by congenital syphilis or albinism, we find that judgments during the last generation have usually accepted as the cause either glaucoma or myopia with detachment of the retina.[1] A careful reading of all of the literature available about Milton's case seems to me to indicate that the trouble was glaucoma. Especially convincing are the halos which he wrote that he saw about bright lights,[2] the fact that blindness did not strike him in either eye all at once,[3] and the fact that both eyes were affected.[4] But it remains, of course, a possibility that myopia or some other malformation or disease was responsible. In this paper I wish to accept without further argument the hypothesis of glaucoma, which seems more plausible, and apply to it some of the findings of psychology during the past two decades.

Probably every ophthalmologist today accepts the theory that acute attacks of glaucoma may be brought on by mental disturbance. Some observation of the "excitable temperament of glaucomatous patients" was commented upon as early as 1819, and there are occasional references to this relationship during the next century.[5] Formal study of the subject began in the late 1920's, when W. F. Inman reported a number of cases showing the psychogenic nature of the disease, with the observation that the effect might be delayed for some time, even for years, though

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1 See Eleanor G. Brown, *Milton's blindness* (New York, 1934) for a summary and evaluation of the evidence through 1933. She favors the latter diagnosis but unfortunately did not have the benefit of consulting a fine study by an ophthalmologist, W. H. Wilmer, "The blindness of Milton," *J. Eng. Germ. Philol.*, 1933, *32*, 301-315, which argues strongly for glaucoma. Since then Lambert Rogers in *J. Hist. Med.*, 1949, *4*, 468-471, has diagnosed Milton's trouble as derived from chiasmal pressure produced by a suprasellar cyst.

2 Letter to Leonard Philaras, 28 September 1654, as quoted and translated by J. Milton French, *Life records of John Milton* (New Brunswick, 1949-1958), III, 417-421.

3 *Ibid.* Several times Milton testifies to this fact, as do all of the early biographies. The point was important because his adversaries interpreted his blindness as a sudden judgment from God.

4 See Brown, pp. 47 ff.

5 Sir Stewart Duke-Elder, *Textbook of ophthalmology* (1948 ed.) as cited in Herbert S. Ripley and Harold G. Wolff, "Life situations, emotions, and glaucoma," *Psychosom. Med.*, 1950, *12*, 215.

one example followed immediately upon a death in the family.[6] By 1940 F. H. Verhoeff could remark that "all ophthalmologists when they are first told anything about glaucoma are taught that emotions precipitate acute attacks."[7] Further important statistical studies have been made since, affording convincing proof that glaucoma has very important psychosomatic relationships.[8]

Primary glaucoma arises, as is well known, from the increase of pressure of the fluid in the eyeball. In the normal eye this fluid drains out as rapidly as it enters; but if the flow is blocked anywhere, the pressure of the liquid increases and in time can destroy the ability of the eye to perceive anything. The blindness which results is permanent. Attacks may come at varying intervals; Peter C. Kronfield observes that "for periods as long as ten years the disease certainly comes to a standstill."[9] There are two distinct types of primary glaucoma, both characterized by raised ocular tension and both leading to blindness. Their initial and developing stages are quite different. The first type, *acute* or *narrow-angle* glaucoma,

> is characterized by episodic subacute attacks of raised tension, the most notable features of which are halos and diminution of vision, and between which the tension is normal. From the less severe of these attacks the eye recovers, but subsequent attacks tend to involve a permanent rise of tension, or a severe attack may abolish vision. . . . It occurs typically in persons, usually women, in the fifth or sixth decade of life, who are of an excitable habit with an unstable vasomotor system. And it occurs in eyes which are usually but not invariably hypermetropic.

The other type is called *simple* or *wide-angle;* it "is not characterized by premonitory symptoms and a turbulent course; on the contrary, it is insidious in origin and slowly progressive. . . . It

[6] "Emotion and acute glaucoma," *Lancet*, 1929, *217*, 1188. See also his "Emotional factor in causation of diseases of the eye," *Trans. ophthal. Soc. U. K.*, 1935, *55*, 423.

[7] Mark J. Schoenberg, "Psychosomatic interrelations: their therapeutic implications in glaucoma," *Arch. Ophthal. (Chicago)*, 1940, *23*, 101 (reporting the discussion of Dr. Schoenberg's paper). See also his "The role of states of anxiety in the pathogenesis of primary glaucoma," *Ibid.*, 76-90, and D. O. Harrington, "Ocular manifestations of psychosomatic disorders," *J. Amer. med. Ass.*, 1947, *133*, 673, which argues that glaucoma is not purely psychosomatic but that "psychic trauma may be an important causal factor in many cases."

[8] See especially Helen L. Hibbeler, "Personality patterns of white adults with primary glaucoma," *Amer. J. Ophthal.*, 1947, *30*, 181-186, reporting on 27 patients of the Washington University Eye Clinic; Franz Alexander and Thomas M. French, *Studies in psychosomatic medicine* (New York, 1948), pp. 555 ff., reporting the study by Dr. Piers of 36 patients at the Illinois State Eye and Ear Clinic; Ripley and Wolff, *loc. cit.* (n. 5), reporting their study of 18 patients; and Allan S. Berger and Carl N. Zimet, "Personality features of patients with primary glaucoma," *Psychosom. Med.*, 1959, *21*, 389-396, and "Emotional factors in primary glaucoma," *Psychosom. Med.*, 1960, *22*, 391-399, reporting upon 19 glaucomatous patients who were compared with 16 controls who had other eye difficulties.

[9] As reported in the discussion in *Glaucoma: A symposium*, Sir Stewart Duke-Elder, Ed. (Springfield, Ill., 1955), p. 301.

occurs equally in either sex a decade later than the first type, affecting persons of no typical psychological pattern. And it occurs in eyes of any type, of any refractive error."[10] I judge that if Milton had glaucoma, he suffered from the narrow-angle type, characterized by sub-acute attacks related to mental disturbance and by hypermetropia. Especially likely to be affected are people who have already made the eyes a center of concern because of some previous trouble or because some member of the family has had some eye difficulty[11]—as did Milton's mother.

Ophthalmologists and psychiatrists who have investigated the subject have come to some agreement upon the type of personality which is most likely to be prone to narrow-angle glaucoma, though agreement about this type is not universal. The closeness with which their descriptions fit the personality of Milton is striking. As an example, Schoenberg describes a garage owner aged 39, whose attacks seem to have been precipitated especially by business worries. When he got away from his business and could relax, his eyes felt better.[12] Ripley too notes that glaucomatous patients were commonly relieved by some such activity as going for a walk.[13] Milton reports that as his disease progressed, his eyes hurt when he tried to read but that he "was refreshed after bodily exercise."[14]

From their study of 18 cases Ripley and Wolff found that "In all the patients there was a history of difficulty in personality adjustment. The most frequent manifestations were mood fluctuations, excessive anxiety, and hypochondriacal tendencies. No definite psychasthenic neurosis was encountered among them. However, compulsive traits such as conscientiousness, meticulousness, and perfectionism were common." Furthermore, "in most patients there was marked body preoccupation and pride in appearance and dress. . . . In most cases other symptoms such as precordial pain, palpitation, headache, urinary frequency, epigastric distress, diarrhea, constipation, and easy fatigability, which appeared to be related to personality reactions, were found."

[10] *Ibid.*, pp. 2-3.

[11] Alexander and French, *loc. cit.* (n. 8); Herbert S. Ripley as reported in *Glaucoma:* Transactions of the First Conference held December 5, 6, and 7, 1955, in Princeton, New Jersey (New York, 1956), p. 42.

[12] "Role of states of anxiety" (n. 7), p. 77. Edward Hartman observes: "Nobody can help noticing that almost all glaucomatous patients are tense, emotional and over-anxious." *Glaucoma,* Duke-Elder, Ed. (n. 9), p. 297.

[13] *Glaucoma:* Transactions (n. 11), p. 45.

[14] *Life records,* III, 420.

The group also had difficulties with family relationships: as a whole they

> had had unsatisfactory relationships with one or both parents and developed feelings of insecurity. . . . Throughout life there was difficulty in developing and maintaining satisfactory mature interpersonal relationships, particularly with marital partners and employers. Need for security and dependence appeared to be a factor in causing them to make impulsive decisions in regard to major events such as marriage. On the whole, sexual and marital adjustment had been unsatisfactory.

Finally, "all of the patients gave a history of anxiety, anger, or depression associated with a frustrating life situation at the time of the onset of symptoms of glaucoma. . . . Aggressive activity, often inappropriate to a satisfactory solution of the problem, was common and might lead to temporary satisfaction but sometimes to further frustration." On the other hand, the authors could not find that any "special type of situation or single emotional reaction" brought on the attacks.[15] S. J. H. Miller independently describes the glaucomatous group as "industrious and conscientious citizens who set high standards for themselves."[16]

From everything now known about him, Milton seems to fit these characteristics almost perfectly. He certainly was worried about his eyes from his youth. His mother had trouble with hers so that she wore glasses from her early thirties.[17] That Milton was conscientious, meticulous, a perfectionist hardly needs argument. For instance, he carefully printed his works and even when blind compiled an errata list for *Paradise Lost*. He attacked in the name of Truth the English bishopric, divorce laws, and censorship in the face of sometimes overwhelming opposition. He optimistically proposed a new commonwealth as Charles II was returning to the throne. He honestly tried to lead a perfect life and wrote various autobiographical passages to prove that he had. His early biographers report his pride in his appearance, to which he himself testifies in his sonnet "On Reaching the Age

15 *Op. cit.* (n. 5), p. 216.

16 "Symptomatology of congestive and simple glaucoma," *Brit. med. J.*, 1952, *1*, 456, as reported in Berger and Zimet (n. 8), p. 389. See also the study of Helen Hibbeler noted above. Berger and Zimet in the two recent reports which have been noted partially disagree with these findings. They agree that "emotions play an important role in the fluctuations of intraocular pressure" but ask whether "glaucoma is an avenue of psychosomatic expression available to people of diverse personality make-ups" or whether there is "a specific 'glaucomatous personality.'" Their study of 19 subjects leads them to conclude that "there is no particular personality configuration specific to glaucoma," though they too observed the industry, conscientiousness, and family blindness among the glaucomatous.

17 John Aubrey, "Minutes," in *The early lives of Milton*, Helen Darbishire, Ed., (London, 1932), p. 5.

of 23;" he later was pleased that his blindness was not apparent. The brief, rather bitter poem written for the engraving in the *Poems* of 1645 shows clearly that he was not indifferent to his public image, as does his self-description in the *Second Defense*. He suffered from headache and epigastric distress during the period of his visual attacks.[18] There is even some testimony as to his dependence upon his father (as in his Latin poem "Ad Patrem"); and finally there is overwhelming evidence of the domestic difficulties which he experienced after his impulsive marriage to Mary Powell in 1642 or 1643, perhaps within a year of the first onset of his attacks.[19] As the sole exception to the general characteristics of the glaucomatously inclined individual, Milton does not seem to have suffered to any marked degree from states of depression.

If his blindness was indeed glaucoma induced acutely by some emotional disturbance, it would be interesting to investigate his biography to see what the precipitating cause might have been. The first problem is that of the date. On 28 September 1654, he wrote to a friend named Philaras: "It is ten years, I think, more or less, since I felt my sight getting weak and faint, and at the same time my spleen and all my inner organs felt uncomfortable and troubled with flatulence."[20] One may then look back ten years "more or less" to see what was happening in his life. In the late summer of 1644, when Milton was nearly 36 years old, *Areopagitica* was probably under way (it was published on 23 November) and some work may have been done on the divorce pamphlet *Tetrachordon* (published the following March). Earlier in the year, on 2 February, the second edition of *The Doctrine and Discipline of Divorce* had appeared, on 5 June *Of Education*, and on 6 August the *Judgment of Martin Bucer*, another in the divorce series. There seems to be nothing in these activities which would arouse unusual excitement for the author. But on 13 August 1644 occurred the first public attack upon Milton's divorce books: Herbert Palmer preached a sermon against them before Parliament on that day. Even though the *Doctrine and Discipline*

[18] *Life records*, III, 420.

[19] Passing mention might be made here of another great writer who certainly suffered from glaucoma: James Joyce. Probably no one has ever compared Milton and Joyce as personalities, but despite their evident differences a reading of Ellman's recent biography reveals surprising similarities too. Joyce, for instance, had various marital problems beginning with his elopement with Nora Barnacle. He shows a great deal of self-attention. In his way he was conscientious in his life, meticulous in his writing, and a perfectionist; despite his visual difficulties, like Milton he published errata lists to correct his main works.

[20] *Life records*, III, 419 ff.

had first appeared a year earlier on 1 August 1643, this seems to have been the first open attack upon it. That it hurt Milton deeply we have the testimony of *Tetrachordon*;[21] even worse was the fact that it was made before Parliament, presumably with its approval. Up to this time Milton had not lost faith in Parliament, for *Areopagitica* is addressed to its members with evident optimism. But then on 24-26 August the Stationers Company petitioned against "the book on divorce," Prynne attacked it on 16 September, a book was registered against it on 31 October, and Palmer's sermon was published in November. On 28 December Milton was summoned before the House of Lords for examination, though he probably did not have to appear.

It seems likely that these attacks, coming as they did from the group with which Milton had identified himself, would inevitably strike him to the quick. He had been castigated before for his antiprelatical pamphlets, but such assaults had been expected from his antagonists. Now the idealist found himself deserted and attacked by the group from which he had hoped to elicit support—naïve though that belief might be. In the two sonnets on the reception of the divorce tracts, usually dated 1646 but perhaps written earlier, and in the poem "On the New Forcers of Conscience" there is further testimony as to how deeply he was cut. As a result of the experience, he had to reorient himself toward the Presbyterians and thus gradually moved into the Independent Party. Such a disillusioning experience would surely provide the shock—a continuing shock during the fall and winter of 1644-1645—to induce attacks of glaucoma in a man already worried about his sight.[22]

A person blind in one eye from glaucoma is likely to be attacked in the other at some later date, and again emotional disturbance is likely to be a precipitating factor. As Schoenberg puts it,

21 *Life records*, II, 105. For all of the evidence presented here, see the *Life records* under the pertinent dates.

22 For those more romantically inclined, Milton was certainly shaken by the return of his wife, Mary Powell. According to Phillips' biography, Milton was planning to marry a Miss Davis when his wife suddenly returned to him and after a short period "of aversion and rejection" he accepted her back (*Life records*, II, 118-120). The difficulties lie in the lack of exact knowledge of Milton's reaction and in the date. As to the latter, since his daughter Anne was born on 29 July 1646 (Phillips says "within a year" of the reconciliation), Mary must have returned not later than early fall, 1645. Masson surmises July or August, and the account of army activities in and about Oxford, near where her home was, bears out this date well enough. But after all, she may have returned earlier. Or one may push a little hard Milton's dating of his blindness "ten years, more or less" to make it nearer nine. Then one may argue that Milton was so upset by Mary's unexpected return that he lost the sight of one eye.

psychotherapy is not applicable to patients with acute glaucoma [because of the immediate crisis in sight which the attack produces]. This does not, however, mean that once the emergency of the acute attack has been taken care of, there is no need for an investigation of the patient's psychic problems and difficulties. His other eye may be in the early stage of glaucoma, and psychic upsets may act in the future as a precipitating factor of ocular hypertensive crises.[23]

Thus we should now turn to the loss of Milton's other eye and the beginning of his complete blindness. French has been able to date his total ocular failure with considerable accuracy as taking place toward the end of February, 1652.[24] In the *Life Records* this date occurs near the finish of some complicated negotiations with Hermann Mylius about a passport for the Count of Oldenburg. One can hardly conclude that Milton was so disturbed about this business that it brought on an attack of glaucoma, though he does mention with irritation "the ignorance and malice of those who enjoyed the plurality of votes."[25] Looking back a month, we find that on 27 January the printer Dugard was arrested for printing the Racovian Catechism. Milton was somehow connected with the investigation, though his exact relationship is not known. I doubt whether there is a causal connection with his glaucoma. Indeed, as early as 1 December 1651, Mylius reports that Milton was almost blind, but there seem to be no factors in his life for a year before February, 1652, which might have brought on the final blindness. It is probably significant that the only handwriting which survives from the period is a signature or so and an inscription or two. Thus probably the simplest solution is to accept Milton's own word for the emotional tension which caused his complete blindness: his physicians had told him that if he persisted in answering Salmasius in the *Defense of the English People* he would lose the rest of his vision. Besides the sonnet to Cyriak Skinner, the early biographers attest to this prognosis, probably reflecting Milton's own statement. The mental agitation aroused by such a prognosis is not difficult to understand. As the author completed the book and it was published in late February, 1651, he would undoubtedly become increasingly apprehensive. A reasonable surmise is that he lost a considerable amount of his remaining vision at this time. A stay in the country which he may have made in the early fall of 1651 may have provided some improvement, but his return to duties for the Council

23 "Psychosomatic interrelations," (n. 7), p. 102.
24 *Life records*, III, 197.
25 *Ibid.*, III, 164.

of State and the frustrations with the Oldenburg passport finally extinguished what little sight remained to him. Perhaps, too, there is more than coincidence in the final loss of sight close to the anniversary of the appearance of the *First Defense,* for there is some evidence that a psychic disturbance connected with glaucoma may occur on anniversaries.[26] It is ironic, indeed, if the prognoses of his physicians helped tip the scales of a man predisposed to glaucoma and precipitated his final blindness.

But one cannot be sure. In Milton's life the difficulty is not to discover a major event which might precipitate an emotional upheaval but to choose which of many it is most likely to be. For Milton was involved from early years to late in bitter arguments with a vast number of people. As has been shown, it is not possible to say what kind of event will trigger an attack of the disease.

Another point of interest remains. As has been mentioned, sufferers from acute glaucoma tend to develop the disease from eyes which are usually but not always hypermetropic. Except for Saurat, students of Milton have generally assumed that he suffered from his youth from myopia and that his mother did too. There is sufficient testimony from both Milton and his early biographers that both suffered from "weak eyes." Today this unscientific terminology almost always refers to myopia; but did it in the seventeenth century? In Milton's case Aubrey records that "his mother had very weake eies, & used spectacles presently after she was thirty yeares old." Did she wear glasses in order to see better at a distance or to see to do close work like sewing? The latter seems more probable in a woman aged 30 who is suffering from hypermetropia, which would normally increase as she became older. Her son also had trouble with the "natural weakness" of his eyes; despite this and "frequent headaches" he read a great deal while in school.[27] But a myope has no trouble reading; his difficuty is to see things at a distance. As a matter of fact he may read throughout his life without difficulty and without any ocular correction. Milton also says "[I] was neither unskilled in handling my sword, nor unpractised in its daily use. Armed with this weapon, as I commonly was, I thought myself a match for any man."[28] Anyone with an uncorrected case of myopia would court disaster if he tried any such exercise. On the other hand, the hypermetrope would, of course, have no trouble at all.

[26] First noted by Inman, "Emotion and acute glaucoma," *loc. cit.* (n. 6).
[27] *Second defense* in *Works* (New York, 1932-1938), VIII, 119.
[28] *Ibid.*, p. 61. He wore the sword even after all of his vision was gone.

His difficulties would lie in reading, and the strain of adjusting his eyes to constant attention to the printed page could well result in headaches and the consideration that such eyes were "naturally weak," though other diagnoses, such as astigmatism, are also likely. Another slight bit of evidence is the fact that in none of Milton's portraits does he wear or carry spectacles (as a myope would be likely to do).

Any case study is difficult enough to make in the flesh. After the lapse of three centuries it is impossible to be conclusive, for the evidence is partial and not accurately reported. Nevertheless, such evidence as survives seems to support the diagnosis which has been advanced here. Besides being a recreational exercise in historical medical studies, it provides further insight into his biography by pointing up the crises in Milton's life in 1644 and 1651.

Hemophilia in Early New England

A Follow-up of Four Kindreds in which Hemophilia Occurred in the Pre-Revolutionary Period

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BETWEEN 1803 and 1817 hemophilia was reported in four kindreds living in New England—Otto's New Hampshire family,[1] Smith's Connecticut family,[2] Hay's Massachusetts family,[3] and another Connecticut family described by the Buels.[4] All four reports described cases of hemophilia which had occurred in the colonial, that is, pre-Revolutionary, period. In each report, patients' (or at least family) names and other identifying information were provided. One is prompted to ask, Who were these families? Were they interrelated? What has happened to the hemophilia gene in these families since the date of report? Was it classical hemophilia or hemophilia B (Christmas disease; PTC deficiency)? This is a progress report on a follow-up study of the four kindreds.

1. The New Hampshire Kindred Reported by Otto

The first of the reports, Otto's account of a New Hampshire family,[1] was the earliest clear description of both the clinical features of hemophilia and its characteristic pattern of inheritance as a sex-linked recessive trait. It stimulated great interest in the disease, here and abroad, leading to the small flurry of reports that followed. The journal in which it was published was America's first periodical, *Medical Repository*,[5] and one of its founders and first editors, Elihu Hubbard Smith, figures later in this history of hemophilia in early New England.

Holderness. Otto (Fig. 1) began his report of 1803 as follows: "about seventy or eighty years ago, a woman by the name of Smith, settled in the vicinity of Plymouth, New Hampshire, and transmitted the following idiosyncrasy to her descendants." Some of the descendants of this Smith were, he wrote, of the name Shepard. Furthermore, he tells us that he had received an account of the disease from the "Hon. Judge Livemore" (*sic*) and that the details

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had been "confirmed by Drs. Rogers and Porter, gentlemen of character residing in the neighborhood."

Plymouth and its environs in the geographic center of New Hampshire were not settled until after the French and Indian War[6,7]that is, not until after 1760. Therefore, Otto's report must be in error in its chronology. Whereas no Shepard settled in Plymouth, six by that name were among the original grantees of adjoining Holderness, which last year commemorated the 200th anniversary of the grant of 1761. Samuel Livermore was also an early settler there. Dr. John Porter practised in Holderness for about ten years before moving to Plymouth in 1780 to read law with Livermore. Dr. John Rogers practised in Plymouth from 1782 until his death in 1814.

Samuel Livermore (1732-1803), lawyer, judge, farmer, miller, squire, represented New Hampshire in the Continental Congress (1780-1782) and was a member of the first Congress, serving in the House of Representatives from 1789 to 1793 and in the U. S. Senate from 1793 to 1801 (Fig. 2). He made a practice of driving from Holderness to Philadelphia in his own coach with Major Thomas Shepard on the box.

In Philadelphia Livermore probably sought out Benjamin Rush and was referred by Rush to Otto. John Conrad Otto (1774-1844) was a former pupil of Rush and, by 1803, a young colleague in practice in Philadelphia.[8] At least one female carrier, the mother of hemophiliacs, was living at the time. She may have urged Livermore to obtain what information he could on hemophilia from Dr. Rush, who was recognized as the leader in American medicine.

Unless Thomas Shepard (*v. supra*) was a hemophiliac or unless Otto visited Holderness in 1802, when he is known to have been in Boston,[*9] it is doubtful that Otto personally observed any of the hemophilic subjects. All his information was second-hand. However, so carefully did he elicit and record the information that his report is remarkably complete and accurate in the essentials; hemophilic arthropathy is, perhaps, the only major feature which escaped his notice.

Local history. Further details on the hemophiliacs of Holderness is provided by an unpublished manuscript made available to me by the local historian. About 1870 Holderness became popular,

[*]In a letter[9] dated 6 August 1802, Benjamin Rush wrote as follows to Dr. John Warren of Boston: "The bearer, Dr. Otto, formerly a pupil of mine and now a respectable physician of Philadelphia, purposes to spend a few days in Boston. Permit me to solicit your civilities to him. . . ."

as a summer resort, with college professors, clergymen, and many others, including the poet Whittier and the family of Ellen Goodrich (1863-1902), the author of the manuscript account. The Goodrichs began summering at Holderness in 1880. Ellen, then 17 years old, went daily for milk to the farm of Helen Severance and her mother, Jane Livermore Shepard Severance (1802-1886). Jane was then "small and bent, with white hair, wearing always a necklace of gold beads, as most of the old women do. When I went for the milk, I often used to find her sitting by the fire smoking a pipe. She would push a chair toward me and say, 'Seems as if you might sit.' While I waited for Helen to finish milking she would wander on about what she did when she was young."

In the Severance parlor was a small lambrequin, a piece of drapery used in those days to hang from shelves or the casing above windows. It was "made of white linen with embroidery in red and blue crewels on it. The pattern was a pretty wandering vine. The blue was still bright, but the red had faded to a dull brown from age." One day Ellen heard the story of the heirloom:

> Mr. Smith was a farmer at Dunstable at the time of the French and Indian War. One day he invited some officers of the army quartered near, to dinner. Among them was Capt. John Shepard, who meeting Susannah the daughter of Mr. Smith, fell in love with her. The father did not approve, but the young people found many opportunities of seeing each other without his knowledge. One day Susannah, her father, and maid went blackberrying. Soon the father grew tired and went home. The daughter begged to stay a little longer. No sooner had the father gone than Capt. Shepard concealed behind a fence with some friends appeared on the scene and carried Susannah off. They went to a church near by and were married. When her father heard she was gone, he set out with all his farm hands to find her. He met a man on the road and asked if he had seen his daughter. "Yes," the farmer said, he had just witnessed the ceremony between her and Capt. Shepard. "Then she aint no daughter of mine," the angry parent said and turned his horse toward home.
>
> Capt. and Susannah Shepard had seven children, some of whom were bleeders (hemophiliacs). Once one of them was ill and it seemed as if he would bleed to death. Mrs. Shepard sent for her father who possessed the secret for curing this mysterious disease. He relented and came, cured the child, and made up with his daughter.
>
> At the time of the Revolution his fellow townsmen tried to make Capt. Shepard join the American army. He had taken the oath of allegiance to the King and refused to go. He was then put in prison. He was such a large man that as he stamped about in his rage he shook the prison walls. When he was released he went to the British camp and enlisted there. The following brings to us very vividly the bitterness of feeling engendered among neighbors at the time of the Revolution. During the battle one of his neighbors in

Dunstable said to a comrade "There's Capt. Shepard. I know him by his height. I love him like a brother, but God send a bullet straight to his heart." He was killed while standing on the deck of a ship off the Grand Manan in the Bay of Fundy.

After Capt. John Shepard's death his wife was left almost penniless. She began to support her large family till they were able to care for themselves. When one of her sons married she embroidered a skirt for her daughter-in-law. Helen's lambrequin is part of this skirt.

Helen also told us the following story: Sometime in the last century a Mr. Cox from Ireland came to America with his family. When reaching Holderness he settled on Cox Hill. His second daughter Esther married Maj. Dick Shepard son of Capt. Shepard. It was for her that the fine embroidery was made by her mother-in-law, Susannah (Smith) Shepard (wife of Capt. John Shepard).

Captain John Shepard (*c.* 1730-*c.* 1779). Miss Goodrich's account is the only record we have of the precise names of the parents of any of the hemophiliacs of Holderness. From original and some secondary sources[10–15,36] a considerable body of information concerning Captain John Shepard can be accumulated. He served in the provincial militia for several years in the early 1750's. In August, 1756, he was captured at Oswego and carried off to Canada. He escaped and was picked up on Lake George by Major Robert Rogers,[10] a previous New Hampshire acquaintance. In February 1757, he joined Rogers' Rangers as Captain of one company. He served in this capacity, with several recorded exploits or at least episodes, until July 1759, when he resigned for reasons of ill health. He lived thereafter in Nottingham, New Hampshire. He was one of the original grantees of Holderness in 1761 but did not move his family there. One source[36] states that Shepard was called "the infamous John Shepard" by the Committee on Safety and gives the following additional information:

In October, 1776, he deserted from the Whig Army, and went to New York. Soon after, he was apprehended with orders sewed in his breeches to enlist men for Sir William Howe, and committed to jail in Connecticut. He escaped, but was again seized and sent to prison in Exeter; and though with irons on his hands and feet and chained to the floor, he escaped a second time.

Shepard served for a time in the Queen's Rangers, established by Rogers to fight for the British in the Long Island area. In 1779 an ill-starred expedition, primarily from Massachusetts but with assistance from New Hampshire, attempted to dislodge the British from the Penobscot Bay.[16] Whether Shepard was killed

during this expedition or in one of the numerous small sea skirmishes of the period is not known.

Susannah Shepard. Shepard's wife Susannah, the daughter of Samuel Smith (1706-1769) and Margaret (Lindall) Smith of Durham (not Dunstable as stated in the Goodrich account), was born in 1739. Her first son, Richard (for whose bride Susannah embroidered the skirt), is said to have been born in 1753, thus establishing one limit for the date of the elopment.

Since hemophilia is transmitted only by the female and father-to-son transmission never occurs, the hemophilia in the Shepard sons did not come from their father; Susannah Shepard must have been a carrier. She probably had had hemophilic brothers (and perhaps hemophilic maternal uncles), accounting for the fact that her father knew a "remedy" for hemophilia, or he himself may have been hemophilic. Otto also referred to the fact that the family had found that orally administered sodium sulfate (Glauber's salts) was an effective remedy for bleeding. Mainly a cathartic, it probably was hemostatic only by producing hemoconcentration and mild circulatory collapse.

Susannah and her family went to live in Holderness when her husband went over to the British. Probably Susannah herself was "the woman by the name of Smith" referred to by Otto. Knowing that the disorder in the Shepards came from her family, Livermore probably told Otto that it was a condition in the Smiths, which had been observed for three or four generations.

Dying in 1813, Susannah Shepard was buried in Holderness in the same lot as her son Richard. Also in that lot are two graves marked by small rough fieldstones. Are these the graves of hemophilic sons?

Potentially hemophilic lines descendent from Susannah Shepard have not been identified. She had two sons who were probably not hemophilic—Richard (1753-1825) and John (1767-1851). The names of her hemophilic sons are not known, nor are the names of any daughters who might be carriers. Here the story must be left. To establish a connection, if any, with hemophiliacs living now or recently, it will be necessary to discover records not presently available to me, or to demonstrate that recent hemophiliacs are direct or collateral descendants of Susannah Shepard and of her mother, Margaret Smith, who may have been a carrier.

Fig. 1. John C. Otto. (From *Bulletin of the Johns Hopkins Hospital.*[8])

Fig. 2. Samuel Livermore. (From an unfinished painting of the first Congress by Trumbull.[7])

Fig. 7. Silhouette of Dr. John Hay.[28]

Fig. 3. Dr. Elihu Hubbard Smith. (Courtesy of The New-York Historical Society, New York City.)

Fig. 4. The present appearance of Dr. Reuben Smith's surgery and apothecary shop in Litchfield, Connecticut.

II. The Connecticut Hemophiliac Described by Elihu Hubbard Smith

In 1794 Dr. Elihu Hubbard Smith, then practising in New York City, wrote to his former teacher, Dr. Benjamin Rush of Philadelphia, describing the unusual and finally fatal hemorrhagic disorder in his cousin. When Otto's report appeared in 1803[1] it stimulated great interest in hemophilia, especially among Otto's colleagues in Philadelphia, and Rush, recalling the letter from Smith (who had died in 1798), gave it to Dr. John Redman Coxe, editor of the *Philadelphia Medical Museum*. Coxe published it in 1805 in the first volume of that journal.[2]

The patient was James Hawley, Smith's cousin, and he lived from 1758 to 1762. The boy's father, Ebenezer Hawley, was a farmer in Farmington, Conn.

An early case report. Smith's full account[2] was as follows:

> James Hawley, was born October 8, 1758, (O.S.) well, and a perfect child. His mother, when a young woman, had been troubled with chlorosis; and had, during her pregnancy with this child, the disorders usually attendant on a pregnant state, very severe: but both the one, and the other, were relieved by the use of a peculiar clay-stone, common in the parish where she was born; and which she was fond of eating. Three weeks before the infant was one year old, he fell, and ruptured the *fraenum* of the upper lip. The lip was filleted down, and to prevent the child's disturbing it, his hands were bound. The infant swallowed the blood, and the stools were coloured with it. The bleeding continued, without the least intermission, till the birth-day—October 8, 1759—and then stopped spontaneously. The 4th of October, 1760, in coughing, the child burst a vessel in the nose. Cold applications did not stop the hemorrhage. Tents were retained in the nostril, and occasionally removed to let out the blood. All the stools were made black, by the blood swallowed: and the hemorrhage did not abate till the birthday —October 8, 1760—when it ceased, as before, spontaneously.
>
> Several days before the child was three years old—it is not remembered, with certainty, how many—the child trode upon a knife, and made a gash, near the little toe, about an inch in length, but *scarcely skin-deep*. This was on Sunday afternoon. The part was bound up; but bled all night. In the morning a physician was sent for, who had said that he could stop the bleeding. He attempted; but ineffectually. The neighbours came in; many things were proposed; but all tried, were of no avail. Among others, a piece of bladder was *glued* on: but it was soaked off by the blood. Lapis infernalis was four times applied in one day. Several other physicians were called in; but their skill was baffled. All these applications had created an ulceration half an inch deep, and two inches long, when the clay-stone was thought of. It was obtained; the child ate it powdered, and the powder was applied to the sore. The blood stopped immediately. But this also happened on the birth-day—October 8, 1761—and whether it was effected by nature, or the clay-stone, may be a question.

Nineteen days before the boy was to be four years old, in drawing an axe out of a log, he let it fall upon his foot; by which the little toe of the right foot, was cut through the bone; and was only held on by a small piece of flesh. The same physician was sent for; and recollecting the supposed efficacy of the clay-stone, the preceding year, he applied it again, but in a stupid manner; as, instead of making a direct application, he bound it on enclosed in a linen rag. He neglected taking off the toe, and bound it on, in hopes that there might be a reunion of parts, by the first intention. Many other applications were made; but proved insignificant. My father, who had just finished his studies, was sent for; but came too late. For several days the discharge had been only of a thin water; the blood seeming to be entirely exhausted. The child, who was my *father's* nephew, died the day *he* arrived; on the 3d of October, 1762—five days before his anxiously-expected birthday. These circumstances were related to me by my aunt, who is still living.

Elihu Hubbard Smith (1771-1798). The author of this case report is an interesting and notable figure for several reasons (Fig. 3). In his short lifetime he established a reputation as a physician, medical journalist, and poet.[17-19] His father, Dr. Reuben Smith (1737-1804), was a Yale graduate and practised medicine in Litchfield, Connecticut, from about 1759 until his death.[18] His surgery and apothecary shop remain today and now does duty as a bookshop (Fig. 4).

After graduating from Yale, E. H. Smith studied medicine for two years with his father, supplementing this apprenticeship with attendance at the lectures of Benjamin Rush in Philadelphia in the winter and spring of 1790-1791. From the fall of 1791 until the spring of 1793 he practised in Wethersfield, near Hartford. In 1793, still only aged 22, he took up practice in New York City. Despite his youth he quickly attained an enviable reputation. In 1795 he wrote his famous "Ten Letters [to William Buel] on the Fever . . . in New York in 1795" in which he contended that the disastrous series of yellow fever epidemics in Philadelphia and New York were due to crowded and unsanitary conditions. Dr. William Buel, who was then practising in Sheffield, Massachusetts, figures directly in a later chapter of the story of hemophilia in early New England.[4] Smith must have known Buel well, for only four years separated them in age and they grew up together in Litchfield.

In 1796 Smith was appointed a physician to the New York Hospital. With Dr. Samuel L. Mitchill and Dr. Edward Miller he launched the first American medical journal, *Medical Repository*,[5] and with them edited it from the summer of 1797 until his death. It was in this journal that Otto published his

pioneering report of 1803, as mentioned earlier. In the yellow fever epidemic of 1798 in New York, Smith, a bachelor, took into his house Dr. Joseph B. Scandella, a youthful Italian physician who was dying of the disease. He himself contracted yellow fever and died on 19 September 1798, shortly after his 27th birthday.

E. H. Smith's activities in the literary field were no less notable than his medical contributions but the details cannot concern us here. He was not yet 17 years old when he wrote some of the earliest American sonnets still extant; his opera *Edwin and Angelina, or the Banditti* was first performed in New York on 19 December 1796; he compiled the first American anthology, *American Poems* (1793), and did much to encourage several young writers. He is labelled as one of the "Hartford Wits" because of his associations with that group while practising in Wethersfield.

The relatives of James Hawley. The hemophiliac James Hawley (Fig. 5) was the son of Keziah Smith (1728-1802), sister of E. H. Smith's father, Dr. Reuben Smith. Either Keziah was a carrier of the hemophilia gene, or mutation to the hemophilia gene occurred in the X chromosome she contributed to her son.

Smith's letter, at least the part published by Coxe, makes no statement, positive or negative, about the occurrence of other cases in the family. Since the familial aspect was emphasized by Otto in 1803, any mention of similar observations by Smith would surely have been published in 1805 and it is probable that other similar cases had not occurred in the family. In view of their dates and places of residence, it is likely that at least three generations were known to the informant, Keziah Smith Root Hawley —her own generation and the preceding and succeeding ones. Some of her daughter's children should also have been known to her at the time she informed Smith. One can presume that Keziah's two other sons were not hemophilic. The lines descendent from them can be traced but are obviously irrelevant if they were not hemophilic.

If Keziah was a carrier, then there is a probability of 0.5 that her one daughter was also a carrier. At the time of E. H. Smith's letter, said daughter had had three sons of whom two were twins (Fig. 5). Assuming that Keziah was a carrier, that all these three grandsons were not hemophilic and that the twins were monozygotic, then one can calculate a probability of $1/8$, i.e., $1/2 \cdot 1/2 \cdot 1/2$, for this set of observations. The probability becomes $1/16$ if the twins

were dizygotic. There is then at least a small possibility that hemophilia has occurred among the descendants of Keziah's daughter (Fig 5). Much less likely, in fact so unlikely that it would be profitless to trace descendants, are the possibilities that Keziah's mother was a carrier and/or that her grandmother was a carrier but that they had no hemophilic descendants within the knowledge of Keziah.

The descendants of Keziah's daughter, who might by the information above have been a carrier, have been traced in

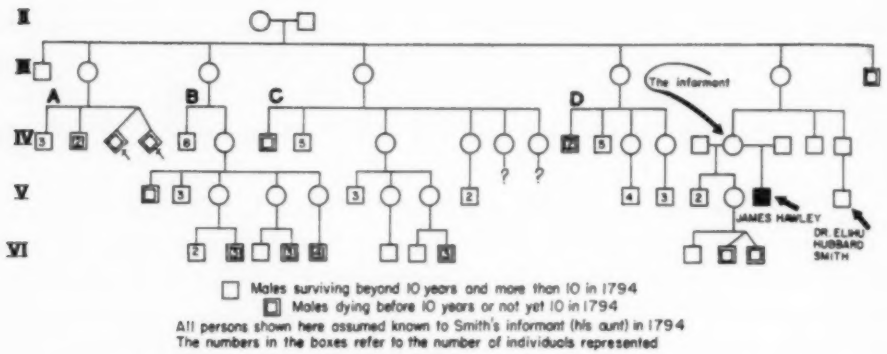

I
II
A
B
C
D
The informant
IV
V
VI
JAMES HAWLEY
DR. ELIHU HUBBARD SMITH
Males surviving beyond 10 years and more than 10 in 1794
Males dying before 10 years or not yet 10 in 1794
All persons shown here assumed known to Smith's informant (his aunt) in 1794
The numbers in the boxes refer to the number of individuals represented

FIG. 5. The pedigree of James Hawley. By inspection it can be seen that, assuming that all males indicated here were known to the informant and were free of symptoms of hemophilia, the chances are very slight that any of the females in generation III who were progenitors of fragments A-D were carriers. The likelihood of finding hemophilia among the descendants in these lines is small, indeed.

considerable detail. A number of living descendants have been consulted directly or indirectly. None of these persons has any knowledge of hemophilia in his relatives. Thus, the evidence at hand is consistent with the view that James Hawley represented a sporadic case of hemophilia, arising through mutation in the X chromosome from his mother.

III. THE MASSACHUSETTS KINDRED REPORTED BY HAY

The third New England hemophilia family to be reported was that of Hay[3] appearing in 1813. Hay's was the earliest report in which sufficient detail was given in the original publication to permit one to assemble a pedigree chart specifically demonstrating the pattern of a sex-linked recessive trait. One can trace the passage of the gene through five generations, starting with Oliver Appleton of Ipswich, a bleeder. Further interest in this family was created

by the follow-up (1885) of Wm. Osler[02] who was able to trace the progress of the gene through two further generations.

Recently I have traced the hemophilia gene back in this family three further generations to the great-grandmother of Oliver Appleton, born about 1590 (Fig. 6). It has, furthermore, been possible to trace the famliy to the present and identify the same hemophilia gene in a living descendant of Oliver Appleton—thereby tracing the gene through almost four hundred years and 13 generations. Nine hemophiliacs have been added to those known to Hay and Osler. The total number of known hemophiliacs in this kindred is 27 and the total number of proved carriers is 25. The prospects are good for being able to determine whether the hemophilia in this family is classic hemophilia (hemophilia A) or Christmas disease (hemophilia B).

Bristol and Newbury. John Oliver[21,22] who emigrated from Bristol, England, to Newbury, Massachusetts, in 1639 was probably the first hemophiliac in New England. Oliver's mother, from whom he must have inherited the gene for hemophilia, was Frances Carey, born about 1590. It is not known whether she was a carrier or whether her son John had hemophilia due to a new mutation in the X chromosome she gave him.

Oliver arrived in Newbury in the company of Percival Lowle (Fig. 6) his sons John and Richard Lowle, and others in the ship *Jonathan*. Before leaving England or shortly thereafter he married Percival Lowle's daughter Johanna.

Percival Lowle, progenitor of the distinguished American Lowells,[23] was one of the most interesting and admirable of the early New England settlers. At the age of 68 years, a man of considerable means, Lowle left his home and business as importer in Bristol to seek a new existence for his family in America. He died in 1665, 94 years of age.

In 1640 a daughter Mary was born to John and Johanna (Lowle) Oliver. If John Oliver was a hemophiliac, then his daughter Mary was necessarily a carrier. On 2 June 1641, John Oliver was appointed to the General Court "to order small causes in Newberry." However, he was either dead or invalided by October, 1641, because Mr. Edward Rauson was "appointed instead of Mr. Oliver." Thus, born in 1613, John Oliver died probably from the consequences of hemophilia, before the age of 29 years. We will return later to the reasons it seems inescapable that John Oliver was hemophilic.

Ipswich. Mary Oliver grew up in the home of her mother and stepfather William Gerrish in Newbury. There, on 8 December 1656, when aged 16, she was joined in marriage to 31-year-old Samuel Appleton, Jr., of Ipswich. Between 1660 and 1679, eight children were born to Mary Oliver Appleton and her husband Samuel (Fig. 6). Mary was not a bleeder but she was quite certainly a carrier for hemophilia. Her son Oliver, born in 1677, was hemophilic and others may have been hemophilic. It was this Oliver Appleton who was the first hemophiliac known to Hay.

Oliver Appleton married Sarah Perkins, daughter of Tobijah Perkins in nearby Topsfield. In the house Oliver built at the corner of Waldingfield Road and County Road in Ipswich, 13 children were born to Sarah and him. Since Oliver was hemophilic, we can feel quite confident that all of his eight sons were free of the disorder and such is reportedly the case. All but one of them had families with numerous descendants which need not concern us here, since no hemophilia can have occurred among them unless introduced from outside the direct Appleton line.

On the other hand, all five of the daughters of Oliver and Sarah Appleton must have been carriers of hemophilia. Two of them died young. The descendants of a third have not been traced. The two remaining daughters married brothers by the name of Swain. With them the scene of this drama moves to Reading where the Swain family resided.

Before continuing with the story of the Swains, it is worthwhile pointing out unusual features of the case of Oliver Appleton of Ipswich. He lived until 1759, dying at the advanced age of 82 years. Such longevity probably approaches a record for hemophilia.* He "was subject from youth to profuse bleeding from slight causes."[3] He probably developed the "rheumatism" typical of hemophilia, the result of bleeding into joints. The Ipswich historian, Felt,[25,26] writing of this same family, stated that the bleeders were "subject to severe and premature rheumatism." In late life he was confined to bed for a long time; bedsores developed and bleeding from these and from the urethra was the cause of death.

Also before proceeding to the Reading descendants, the Swains, let us consider why it seems likely that John Oliver was hemophilic.

* Ikkala[24] describes a patient (AII, 1, III-10) who lived to the age of 71 despite being afflicted with classic hemophilia and two patients with hemophilia B (B III, 1, III-4 and B III, 2, III-16) who lived to 83 and 80 years, respectively.

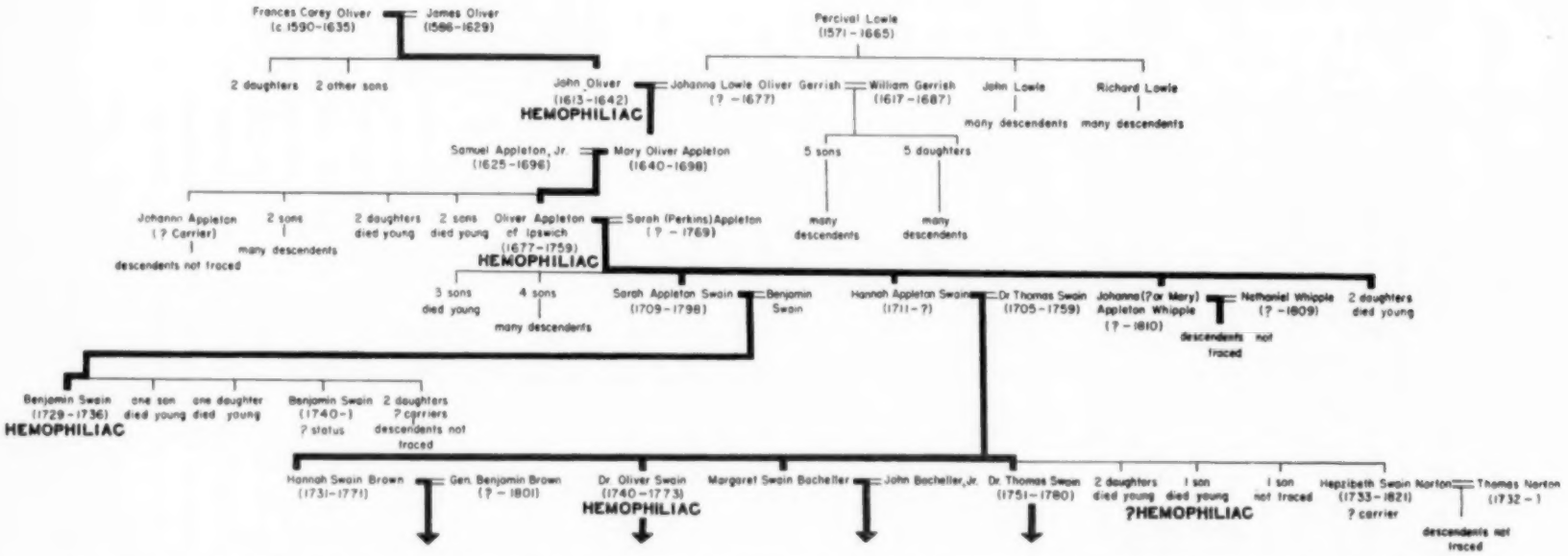


FIG. 6. Pedigree up to time of John Hay. The heavy line indicates the lines of passage of the hemophilia gene. The line of transmission antecedent to Oliver Appleton is somewhat uncertain; see text.

His daughter Mary Oliver was probably a carrier since his grandson Oliver Appleton was hemophilic—the main alternative being that mutation occurred in the X chromosome Mary contributed to her son. If she was a carrier, Mary Oliver could have received the hemophilia gene from either a hemophilic father or a carrier mother.* The mother, Johanna Lowle, had only two brothers, neither of whom can, by the limited information available, be suspected of having had hemophilia, nor is there any record of hemophilia among their descendants. Admittedly, hemophilic brothers of Johanna might have died before the Lowles emigrated. Remember, her father, Percival Lowle, was 68 when he came to America.

The strongest evidence against the notion that Johanna Lowle Oliver was a carrier is her family by Captain William Gerrish, whom she married in 1645 after the death of her first husband. William Gerrish and Johanna Lowle Oliver Gerrish had five sons and five daughters. Most of them left descendants. Persons of the Gerrish name, their descendants, are numerous in New England and live in many parts of the United States.[27] The failure of the earlier chroniclers to note hemophilia in the descendants of Johanna by Gerrish and only in the descendants of Johanna by Oliver is as convincing evidence as one has a right to require at this late date—evidence that Johanna was not a carrier and indirectly that John Oliver was hemophilic. His death at an early age is further support, although alone no proof.

In 1832 Felt wrote:[25,26] "This hemorrhage first appeared in the Appleton family, who brought it with them from England." Genetic knowledge can prove the inaccuracy of the statement. Oliver Appleton, grandson of the emigrant, was the first and as far as we know the only hemophiliac of the Appleton name. A male hemophiliac can have gotten the gene *only* from his mother, in this case Mary Oliver.

Grandidier, who contributed to the literature on hemophilia between 1855 and 1879, suggested[44] that it was fortunate that hemophilia was unknown in the times of witchcraft and the persecutions for same; otherwise the victims of their acquaintances might have suffered grave consequences. From the records of the family reported by Hay we know that hemophilia did exist in eastern Massachusetts at the height of the witchcraft frenzy. Yet no dire effects were recorded.

* Or mutation might have occurred in gametogenesis in one of the parents of Mary Oliver.

Reading. Sarah and Hannah, daughters of hemophilic Oliver Appleton and therefore obligatory hemophilia carriers, married brothers, Benjamin Swain and Dr. Thomas Swain, sons of Dr. Benjamin Swain and grandsons of one of the first settlers of Reading (Fig. 6). Hemophilia skipped a generation at this point. It always skips at least one generation among the descendants of a hemophilic male. We have seen previously a generation skipped between John Oliver and Oliver Appleton.

Benjamin Swain and Sarah Appleton produced six children. At least one of the sons was hemophilic although he died of "throat distemper," diphtheria, as did some of his siblings. One daughter probably had descendants but has not been traced. Consequently, in this branch known hemophilia stops with a hemophilic male who died in 1736.

Dr. Thomas Swain and his wife Hannah Appleton had nine children among whom two daughters were known carriers and two sons known hemophiliacs. Their two hemophilic sons were physicians in Reading, like their father. Dr. Oliver Swain, born in 1740, died in the summer of 1773 following an injury to his leg from a kick of a horse. Among his descendants, several grandsons were hemophilic. Dr. Thomas Swain, Jr., born in 1751, and described as an eminent physician,[28] died in 1780 of hemorrhage from a penknife wound of the finger. He also had hemophilic grandsons.

The two carrier daughters of Dr. Thomas Swain, Sr., and Hannah Appleton were Hannah, who in 1749 married General Benjamin Brown, and Margaret who married John Bacheller, Jr. Hemophilia has been traced for three generations among descendants of the first and for four generations among the descendants of the second. Nathaniel Brown, a hemophilic son of General Benjamin and Hannah Brown, was born in 1756 and died in 1832, approaching with his 76 years the longevity attained by his hemophilic great-grandfather Oliver Appleton of Ipswich.

Mary, daughter of Dr. Oliver Swain, married Jeremiah Hartshorne, who at the age of less than 20 years fought actively in the American Revolution. He and Mary married in 1786 and went to live in the northerly part of the old Hartshorne mansion on Elm Street in South Reading, now Wakefield. To them were born, between 1787 and 1802, three bleeder sons. This brings our story up to 1811 and to Dr. John Hay, who lived next door to the Hartshornes and to whom we owe most of the information on the

five generations of this family beginning with Oliver Appleton of Ipswich.

Dr. John Hay (1737-1815). Hay's father, Dr. William Hay, came to Reading from Scotland, married a Reading girl in 1717, practised medicine in Reading all his life and died there in 1783 at the age of almost one hundred years.[28] In addition to his description of hemophilia, Dr. John Hay (Fig. 7) has a second claim to fame: about 1771 in Woburn where he first practised he had as an apprentice a young local farm boy named Benjamin Thompson (1753-1814), later the renowned physicist Count Rumford.[29]

Hay's report entitled "Account of a Remarkable Haemorrhagic Disposition Exisiting in Many Individuals of the Same Family" appeared in 1813, in the second volume of the *New England Journal of Medicine and Surgery, and the Collateral Branches of Science.*[3] However, from internal evidence it is clear that the septuagenarian physician undertook to set down what was probably the most interesting set of observations of his professional lifetime in 1811.

Nasse,[30] a professor of medicine in Bonn, Germany, is generally credited with pointing out (in 1820) the characteristic patterns of transmission of hemophilia—it is sometimes called Nasse's Law. However, the American physicians, Otto, Hay, and the Buels,[4] who described the New England families before Nasse, had a clear notion of the pedigree pattern, and Nasse had access to their reports. Hay wrote: "The children of bleeders are never subject to this disposition, but their grandsons by their daughters." Hay had access to Otto's report. We cannot say whether he would have recognized so clearly this feature and several of the others he commented on if Otto had not pointed it out ten years previously.

Hay (like Otto, Smith, and the Buels) did not use the designation *hemophilia;* this came somewhat later. The term seems to have been invented about 1828 by Schönlein (1793-1864), a professor of medicine in Würzburg, and was first used in print by his student Hopff.[35] It seems likely that the original term was *hemorrhaphilia,* which makes more etymological sense than hemophilia.

William Osler. About 1884 William Osler, then Clinical Professor of Medicine at the University of Pennsylvania, was preparing the section on Diseases of the Blood for William Pepper's *System of Practical Medicine.*[20] After studying Hay's report of what he

now called hemophilia, Osler attempted a follow-up by writing to Dr. Francis Frederick Brown of Reading. The most recent case of which Brown could tell him was that of a lad named Warren Coburn (1853-1870), great-grandson of Margaret Swain Bacheller (Fig. 8-A).

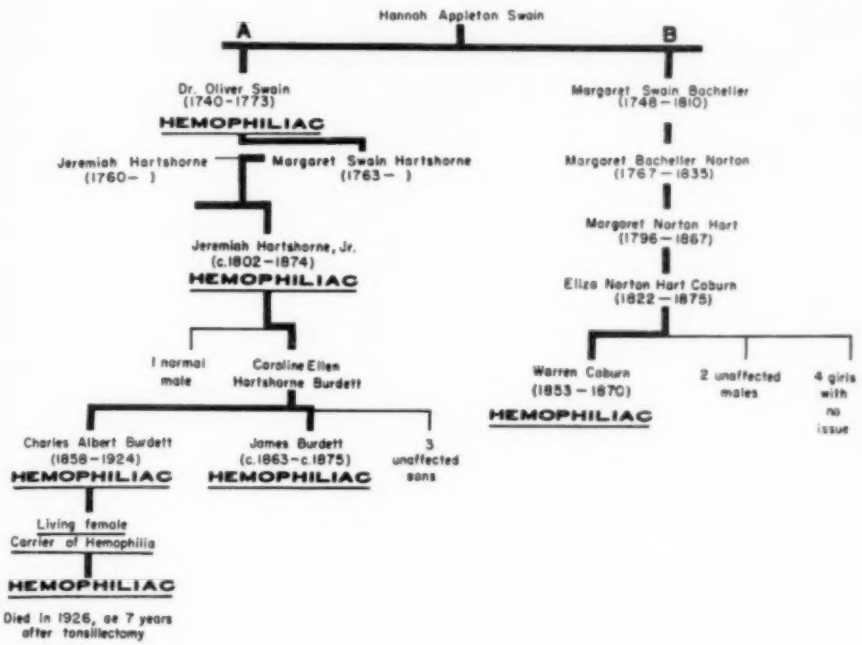


FIG. 8. A. Fragment pedigree of presently living hemophilia carrier. B. Fragment pedigree of the branch followed up by William Osler. The last case Brown has been able to ascertain was in a lad, Warren Coburn, aged 17, who died about 12 years ago. His mother's brother was a bleeder and died of hemorrhage from a slight scalp wound after having been brought to death's door on three or four other occasions by trivial wounds. Mrs. Coburn was a daughter of Daniel Hart, whose wife was a Norton. Her mother was a Bacheller and a granddaughter of Oliver Appleton's daughter. This lad is an instance of the transmission of the disposition to the seventh generation within a perod of two hundred years (Osler, 1885[20]).

Osler made the following cogent comment on the difficulties of tracing the disease: "As the tendency is chiefly transmitted through the female members of a family, who lose the patronymic by marriage, it is often difficult to trace the relationship. I think if we had fuller genealogical details we should find that several of the bleeder families now thought to be distinct belong to the same stock."

Royalston. In 1777 John Bacheller, Jr., and his wife Margaret Swain, both born in Reading, moved to Royalston[31] toward the center of Massachusetts near the New Hampshire line. John Norton Bartlett (1819-1905), a grandson of Margaret Swain Bacheller and prominent citizen of Royalston, has provided most of the information we have on hemophilia in the Royalston branch.[31] He stated that Margaret had three hemophilic sons, one hemophilic grandson, three hemophilic great-grandsons, and one hemophilic great-great-grandson. Seven of these eight hemophiliacs can be identified in published genealogies and other sources.

Hay told us that three sons of Margaret and John Bacheller were hemophiliacs, a matter confirmed by Bartlett,[32] who provided the following details among others:

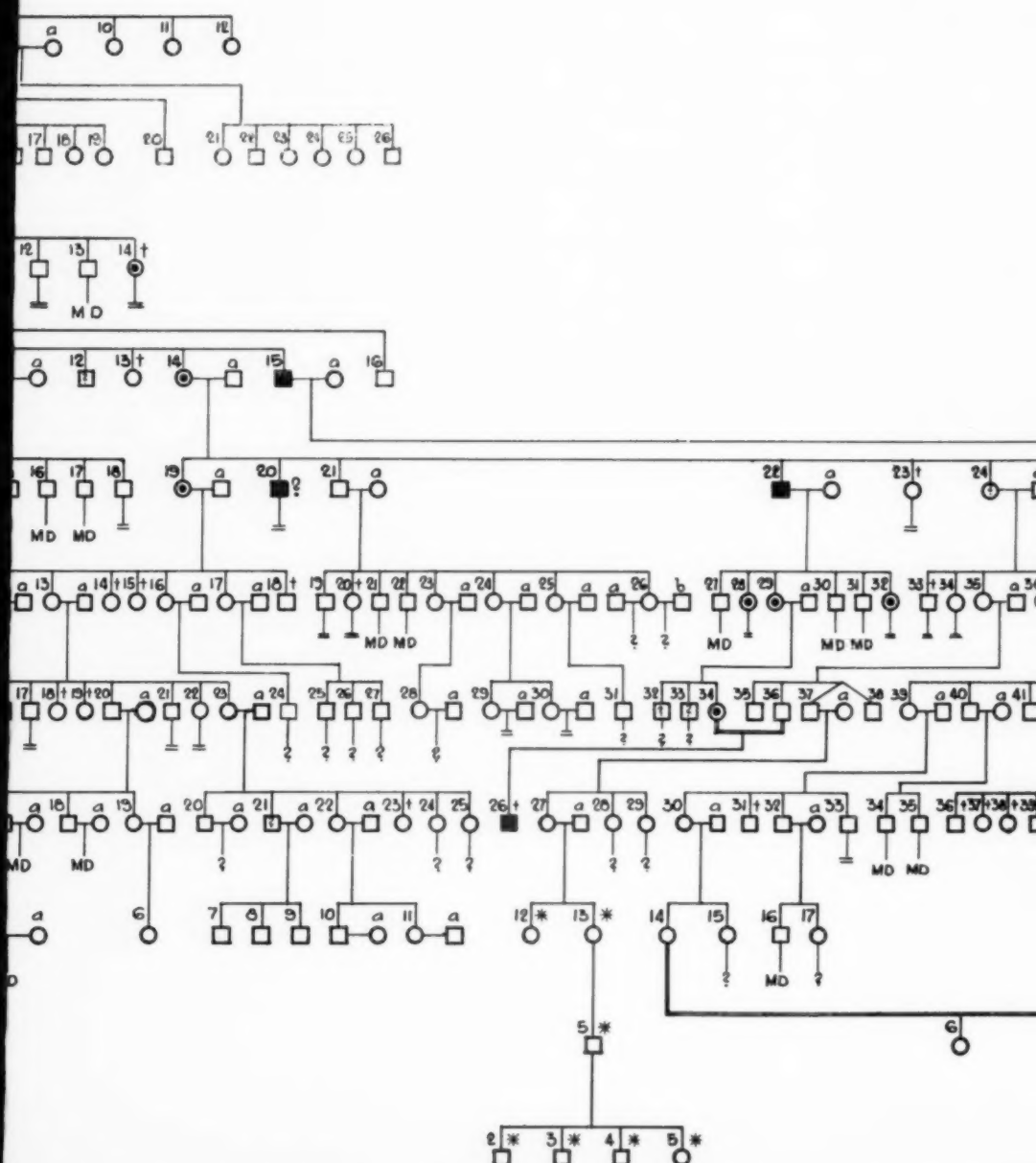
> One of the sons, Thomas, while in the act of making a pen, accidentally penetrated the skin upon the end of his thumb with the point of the knife. The rupture was too slight, however, to have attracted the least attention from an ordinarily constituted person. But, in about two weeks, a cone (the certain precursor of bleeding) began to form, and a hemorrhage soon followed, from which he nearly lost his life. At another time a very slight wound upon his foot resulted similarly.

This Thomas Bacheller (1773-1845) lived for 72 years.

The hemophilia gene today. The hemophilia gene which John Oliver is thought to have brought to this country in 1639 possibly persists today in a number of individuals. To date, however, only one such individual, a female carrier born in 1892, has been identified. This person (Fig. 8-A) is a great-granddaughter of a hemophilic son of Jeremiah Hartshorne who lived next door to Dr. John Hay. Since her father, who survived to 66 years, was hemophilic, she is necessarily a carrier. She had a hemophilic son who died at seven years after tonsillectomy. Living hemophilic males are being sought among the pertinent descendants of this family.

Determination of the type of hemophilia in this kindred would be relatively simple by laboratory study of a hemophilic descendant. Detection of minor deficiencies of antihemophilic globulin (AHG) or of plasma thromboplastin component (PTC) in carriers of hemophilia A or B, respectively, cannot be depended on for an answer. However, if one or the other clotting factor shows a definitely and consistently low level in the blood of a hemophilia carrier of this family, then success in identifying the type of hemophilia in this historic family will have been achieved.

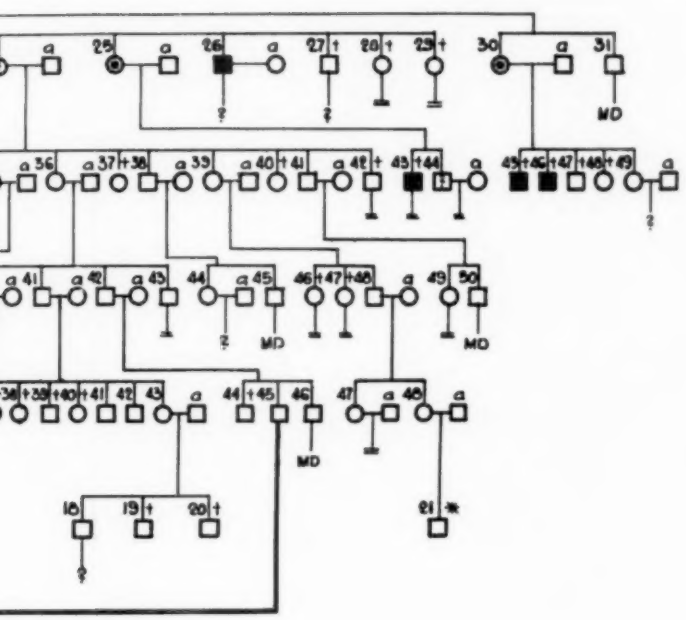
FIG. 9. The full pedigree of the Massachusetts



the Massachusetts kindred first described by Hay. A full legend will accompany a later pu

LEGEND

† Died Young
■ Hemophilic male
◉ Carrier female
? Status uncertain
⊥ No issue
MD Many descendants but not relevant.
* Living traced descendants



r publication.

Recently, assays for anti-hemophilic globulin in the one living carrier (XII 2) identified in this family has revealed significantly depressed values.[37] It is estimated that the probability of the values in this carrier being normal is less than .05, possibly as little as .01. It is concluded that the hemorrhagic diathesis in this family is classical hemophilia (hemophilia A).

The pedigree pattern for hemophilia in the Massachusetts kindred, as reported by Hay and Osler and amplified here, is completely characteristic of a sex-linked recessive trait (Fig. 9).

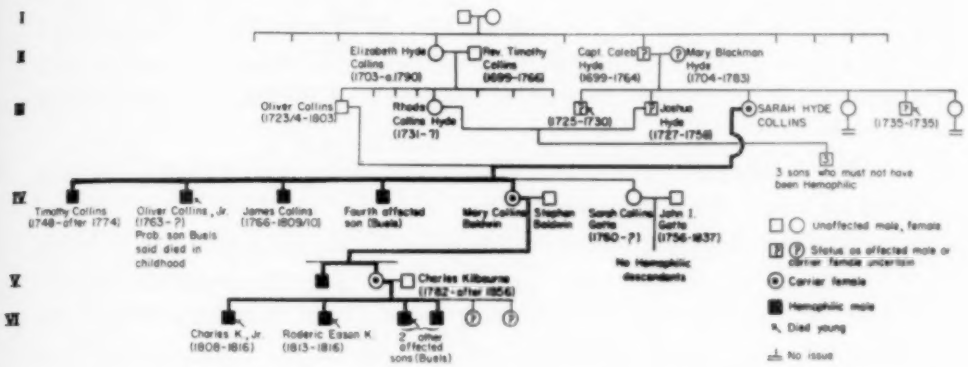


FIG. 10. Pedigree of the family reported by the Drs. Buel.

In fact this is the longest-traced pedigree of any sex-linked trait. Although some autosomal dominant traits have been traced back to the fourteenth century (e.g., symphalangism[31]) or even earlier, the only sex-linked pedigree approaching Hay's in antiquity is that of hemophilia B in the Tenna district of Switzerland.[34] The clinical behavior of hemophilia in this family and several genetic considerations are discussed elsewhere.[37]

IV. The Connecticut Family Reported by the Doctors Buel

Litchfield, Connecticut, has already played a role in this story of hemophilia in early New England since Elihu Hubbard Smith grew up there and his father was a physician there for most of his life. For at least three generations Litchfield was the place of residence of the family with hemophilia reported by the Drs. Samuel and William Buel in 1817.[4] As in the earlier discussed cases, the first case of hemophilia in Litchfield occurred in the pre-Revolutionary period. The first unequivocally identified person with the gene (Fig. 10) was a carrier, Sarah Hyde Collins,

born in 1729. The first positively identified hemophiliac in this family was her son Timothy Collins, born in 1748.

The Doctors Buel. John Buel (1671-1746) was, like the Rev. Timothy Collins (see below), one of the earliest settlers of Litchfield. Drs. William and Samuel Buel were, respectively, the oldest and youngest of the six children of John Buel's grandson. Both were born and raised in Litchfield.

Dr. William Buel (1767-1851) was graduated from Yale College. In 1796 he married Abigail Bacon of Sheffield, Massachusetts, and for many years he practised there. Late in life he returned to Litchfield. It was to Dr. William Buel of Sheffield that Elihu Hubbard Smith wrote the well-known letter which expounded his theory of yellow fever[45] and which was published by Noah Webster in his *Papers on Bilious Fevers* (1796).

Dr. Samuel Buel (1782-1854) was born in Litchfield, always lived in Litchefield, and died there. He received his medical training by apprenticeship. He practised medicine for nearly fifty years in all and for many years before receiving an honorary M.D. degree from Yale in 1826. In 1819 he married Minerva Wadhams (1793-1865), a great-granddaughter of the Rev. Timothy Collins.

The Rev. Timothy Collins. The Buels began their report as follows: "The subjects of the following account are the descendants of the Rev. Timothy Collins, the first pastor of the town of Litchfield, Connecticut." Collins (1699-1776) was born in Guilford, Connecticut, and received the M.A. degree in 1718 from Yale where he studied medicine and surgery as well as theology.[42] Along with Joseph Kilbourn of Wethersfield, John Buel of Lebanon and others, he founded the new settlement at Litchfield about 1721.[38–40] He was ordained minister of the Congregational Society at Litchfield in 1723. In accordance with the practice of the period, Collins as first minister received a sizable land grant (one sixtieth of the area of the township). He proved to be what we would now term a controversial figure. One biographer[42] states that "the engrossing demands of this avocation [medicine], with the wealth which the favorable terms of his settlement brought him, seem to have caused what the town records style 'the people's uneasiness with him' as early as 1728." He was finally dismissed from the pulpit in 1752. He continued to live in Litchfield and took up the practice of medicine as his avowed vocation. Twice in the French and Indian Wars he went with the provincial

militia as surgeon—in 1755 against Crown Point and again in 1762.

Rev. Timothy Collins could not have been hemophilic because the Buels stated further that "so far as we have been able to ascertain, the first manifestation of hemorrhagic predisposition was in the male children of his son Oliver." Oliver likewise cannot have been hemophilic; his sons must have inherited the hemophilia gene from their mother Sarah Hyde Collins.

[*The family as reported by the Buels.*[4]] Oliver Collins had four sons and two daughters. In all of the sons, this predisposition discovered itself, in an extreme degree, from early infancy, and continued through life. Three of them bled to death. It is not known where the fourth is, or whether he is alive. Two of them, although frequently reduced by hemorrhage to a state of exhaustion threatening the extinction of life, lived to adult age. One of them, eventually died from a hemorrhage induced by the extraction of a tooth; the other, from a hemorrhage following a slight contusion of the forefinger. The one which died in childhood, bled to death from a slight laceration of the tongue by the teeth, occasioned by a stroke under the chin. It is related of these persons, that after experience had taught them their liability to hemorrhage, they acquired an extreme sensibility in relation to their danger,—shuddering at the sight of edge tools, and avoiding, with the utmost caution, all exposure to them.

Documentation has been found for three sons: Timothy Collins, born in 1748, Oliver Collins, born in 1763, and James Collins, born in 1766. The date of death of none of the three is known.

The next appearance of a disposition to bleeding, was in a son of Mrs. Baldwin, one of Oliver Collins's daughters. It may be noticed here, that the other daughter, Mrs. Gatty, has both male and female descendants, in none of whom has this hemorrhagic constitution appeared. Mrs. Baldwin's son possessed it in an equal degree with his uncles. He lived, we believe, till near the age of puberty, when he bled to death from a slight wound caused by the fall of a pewter plate on his foot.[4]

Oliver's daughter, Mary Collins, married her first cousin Stephen Baldwin. Nothing is known about their children except what the Buels tell us, namely, that one son died young of hemophilia and a daughter, who was like her mother a carrier, married Charles Kilbourne (see below).

Oliver's daughter, Sarah Collins, in 1791 married John I. Gatta, whose name was corrupted to Gatty by the Buels. Gatta (1756-1837) had a interesting life-story. He was known in Litchfield as "the Hessian" because he was born in Hesse Castle, Germany, the son of a well-to-do baker. He was presumably pressed into service as a Hessian mercenary for King George III

but escaped from a ship in New York harbor. He joined a New York regiment and for the rest of the war fought with the Americans, working as a baker, the trade he had learned from his father. A Litchfield historian[40] recorded that "his descendants are now among our most respected people."

The report by the Buels was based on personal observations only of the sons of Charles Kilbourne and the Baldwin granddaughter of Oliver Collins. Kilbourne, born in 1782, the son of Captain Lewis Kilbourne of Litchfield, had several children. The Buels stated that there were four sons, all bleeders. One of the bleeder sons drowned at the age of 18 months. A second died from "a hemorrhage proceeding from a wound produced 48 hours previously by a stub penetrating the bottom of the foot." A third son "died after extreme exhaustion induced by nasal bleeding."

The two sons just mentioned—Charles Kilbourne, Jr., aged eight years, and Roderick Eason Kilbourne, aged three—died in 1816, in the summer preceding the Buels' report. Soon thereafter, in 1816, Charles Kilbourne moved his family to Brockville in what was then called Canada West and what is now Ontario.[41] Others of the Kilbourne family had previously moved to Canada out of loyalty to the British crown. Presumably Charles took with him "the only surviving son [who had] been frequently reduced to a state of exhaustion threatening life, by hemorrhage from the nostrils, small lacerations of the fraenum of the upper lip, and slight wounds in various parts of the body." At least two daughters who may have been carriers of hemophilia and who were too young to have been married probably accompanied their parents to Canada.

Here the trail ends. None, it seems, of the persons of the name of Kilbourne now in Canada have been found to descend from Charles K. Possibly Charles Kilbourne's one surviving son did not have children so that the only possible survival of the hemophilia gene would be in descendants through the daughters of Charles. The change in name with marriage of the daughters introduces the well-known difficulty attendant on the tracing of sex-linked recessive traits.

The antecedents of Sarah Hyde Collins. Sarah Hyde Collins, who clearly was a carrier of hemophilia, may have been a new mutant or her mother may have been a carrier. Presumably her father was not hemophilic; otherwise the Buels would have known it. However, hemophilia is occasionally so mild as to be

overlooked. Sarah's parents were Captain Caleb Hyde (1699-1764) and Mary (Blackman) Hyde (1704-1783), who lived most of their lives in Lebanon, Connecticut, and raised their family there.

Hemophilia may have occurred in brothers of Sarah Hyde Collins and have passed from the memory of any with whom the Buels made their "diligent inquiry" almost one hundred years later. Two of these brothers—Caleb Hyde (1725-1730) and Caleb Hyde 2nd (1735-1735)—indeed died young. A third son Joshua Hyde, born in 1727, died at the age of 31 years. He was one of the four husbands of his first cousin Rhoda Collins (1731- ?), a daughter of Rev. Timothy Collins. He and Rhoda had three sons and no daughters. Even if Joshua was hemophilic, none of his sons could have inherited the disease from him. Therefore, tracing their descendants would be profitless. No daughter of Caleb and Mary Hyde, other than Sarah, produced children.

It is of course not known whether Sarah Hyde Collins was a carrier as a result of a new mutation or of having received the hemophilia gene from one of her parents, either a hemophilic father or a carrier mother. I favor the view that two or more of her brothers were hemophilic and—as a necessary corollary—that she inherited the hemophilia gene from her mother.

So again in this family, as in that of Otto, further tracing will necessitate more genealogical information (particularly on the descendants of the daughters of Charles Kilbourne); or, as in the families of Otto and Smith, a demonstration that recently or presently living hemophiliacs are related to those referred to in the early reports.

An Interim Summary

A follow-up study still in progress has had these results:

1. A previously unpublished record of local history reveals that the family reported by Otto is historic not only for medical and scientific reasons but also because of its connections with Captain John Shepard who figured in the French and Indian Wars and in the War of the American Revolution. Hemophilic descendants have not ben traced.

2. Both Elihu Hubbard Smith and the case of hemophilia he described in his cousin are of interest. It is concluded on the basis of probabilities, supplemented by questioning pertinent living descendants, that the case Smith described was sporadic.

3. In the Massachusetts family first reported by Hay the hemophilia gene has been traced from a woman born in Bristol, England, about 1590 to a woman now living in New Hampshire. A total of 27 male hemophiliacs and 25 female carriers distributed through 13 generations have been positively identified to date.

4. In the Litchfield, Connecticut, family reported by the Doctors Buel the gene can be traced through four generations from a female carrier born in 1729 to hemophilic great-grandsons who died in 1816. The antecedents of the original female carrier are known, but information on the existence of hemophilia is lacking. Because of migration from Litchfield to Canada, a pertinent branch of the family is lost to further genealogical study.

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Development of Hospitals in Islam

SAMI HAMARNEH*

IN this article an attempt will be made to trace and evaluate the major factors leading to the rise and development of hospitals in the Islamic domain from the eighth through the thirteenth centuries. The article, being in no way a comprehensive survey, will discuss only a few principal hospitals of historical interest which, founded by enthusiastic physicians and patrons, helped materially to advance Arabic medicine during that period.

A careful examination of Islamic history shows that for more than a century after the death of Muḥammad (632 A.D.), the caliphs directed the energies of their people toward further conquests and the spread of the new faith among the nations they invaded. They endeavored both to consolidate the Empire and to interpret and perpetuate the Islamic religion. This great task, demanding physical as well as spiritual powers, left little time for the achievement of scientific aims.[1] To the Arabs, moreover, the treasures of the Greek learning were still undisclosed except for slight influence from Syriac translations[2] and the advantage of intermittent association with the medical schools of Jundī-Shāpūr (southwestern Iran)[3] and Alexandria in Egypt.[4]

Nevertheless, the fragmentary information that has come down to us from the historian, al-Maqrīzī (1364-1442), indicates that

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1 This inference was confirmed earlier by the eleventh century historian Ṣā'id ibn Aḥmad al-Andalusī, *Ṭabaqāt al-Umam*, Louis Cheikho, Ed. (Beirut, 1912), 47. See also a similar reflection by De Lacy O'Leary in *Arabic thought and its place in history* (London, 1954), 80; and in Aldo Mieli, *La Science Arabe et son rôle dans l'evolution scientifique mondiale* (Leiden, 1938), 48-49.

2 The Jewish physician Māsarjawayh of Baṣrah (Iraq) translated from Syriac into Arabic the medical "Kunnāsh" of Aḥrun the Priest. The book comprises thirty treatises to which Māsarjawayh added two more. See Muḥammad ibn Ishāq ibn al-Nadīm, *al-Fihrist* (Cairo, 1930), 427. This well-known translation (*ca.* 720 A.D.) referred to frequently in medical writings of the period is considered one of the earliest of its kind in Arabic. Max Meyerhof, "The background and origins of Arabian pharmacology," (*Ciba Symposia*, 1944, *6*, 1853) dates this translation during the reign of Marwān II (744-750).

3 The school of Jundī-Shāpūr reached a high degree of cultural prosperity during the rule of the illustrious Sasanid king Anusharwan (531-579). Its teaching was being conducted mainly in Syriac by Nestorian Christians when the city was conquered in 636 by the Arabs. Its real impact upon Arabic medicine came in greater measure over a century later, bringing with it Persian influence as well. Hence the Persian word "bīmāristān" meaning house or establishment for the sick was incorporated in Arabic for a hospital. See Donald Campbell, *Arabian medicine and its influence on the middle ages* (London, 1926), vol. 1, 45-48.

4 Among the famous physicians of the once greatly renowned medical school of Alexandria was 'Abd al-Malik ibn Abjar al-Kinānī who also about 718 transferred his school from Egypt to Syria. See Ibn Abī Uṣaybi'ah, *'Uyūn al-Anbā fi Ṭabaqāt al-Aṭibbā* (Beirut, 1957), vol. 2, pt. 1, 12, 24.

the Umayyad Caliph of Damascus, al-Walīd in 706 A.D. built the first hospital known in Islam,[5] a statement that found acceptance and has been propagated by historians of Arabic medicine in our time.[6] However, careful examination of a much earlier and more reliable source, the history of al-Ṭabarī (d. 923), shows that al-Walīd's generous act of helping the sick was mainly a philanthropic decree to aid the blind and the disabled and to establish separate quarters wherein lepers could be confined[7] to prevent the spread of the disease.

It should be stated here, too, that the Arabs, especially during the Umayyad period, were greatly influenced by the Byzantine civilization,[8] not only in their administrative system but also in their economic and cultural development.[9] This is evident from the fact that, for the most part, Syria was Hellenized from the fifth century up to the advent of Islam, where Greek continued to be the language of learning.

In 750 A.D. the Abbasids came to power and the center of activity moved from Syria to Iraq. Here, medical practice was brought under the direct influence of the medical school and hospital of Jundī-Shāpūr[10] already mentioned. The challenging contact was stimulated and encouraged by Caliph al-Manṣūr and his immediate successors. In 766, al-Manṣūr summoned the director of the school, Jurjis ibn Bakhtīshū', to become court-physician[11] in his newly built capital, Baghdād.[12] This city, during the following three decades, grew tremendously in popu-

5 Taqī al-Dīn Aḥmad al-Maqrīzī, *Kitāb al-Khiṭaṭ* (Cairo, 1853), vol. 2, 405.

6 Aḥmad 'Isā, *Tārikh al-Bīrmāristānāt fī al-Islām* (Damascus, 1939), 10; and Amīn A. Khairallah, *Outline of Arabic contributions to medicine* (Beirut, 1946), 60.

7 Muḥammad ibn Jarīr al-Ṭabarī, *Tārikh al-Umam wa al-Mulūk* (Cairo, n.d.), vol. 8, 97.

8 Steven Runciman, *Byzantine civilization* (3d ed., London, 1948), 291-293.

9 All state records in Damascus, capital of the Islamic Empire under the Umayyads, were retained in Greek by Syrian Christians of the Semitic race up to almost the end of the seventh century. Thereafter, learned men among these Christian groups who kept alive the teaching of the Greeks helped greatly in the progress of cultural development in Islam. See al-Maqrīzī, *al-Khiṭaṭ*, vol. 1, 98.

10 Edward G. Browne, *Arabian medicine* (Cambridge, 1921), 19; and Max Meyerhof, "Science and medicine," in *The legacy of Islam*, Thomas Arnold and Alfred Guillaume, Eds. (Oxford, 1952), 335.

11 Jamāl al-Dīn al-Qiftī, *Ikhbār al-'Ulamā bi Akhbār al-Ḥukamā* (Cairo, 1326 A.H. [1908 A.D.]), 109-110.

12 Al-Manṣūr built Baghdād (a Persian word meaning the gift of the god) between 762-66 inside two circular walls, with his palace in the center of the city. He called it "Dār al-Salām" (the abode of peace) as he no doubt wished to be safe from his enemies, especially the Rāwandiyah (a sect of Persian extremists) who tried to assassinate him in his first capital al-Hāshimiyah near Kūfah. See Abū Bakr al-Khaṭīb al-Baghdādī, *Tārikh Baghdād* (Cairo, 1931), 66-70; and Abū al-Fidā Ismā'īl al-Dimashqī, *al-Bidāyah wa al-Nihāyah* (Cairo, 1933), vol. 10, 96-97. This old city of Baghdād being built mainly with adobe (sun-dried bricks) was completely destroyed and its exact location has not been finally determined. The northwestern side of present day Baghdād, between al-Ju'ayfir and Mosque Ma'rūf, is the most widely accepted suggestion.

lation, wealth, and importance and rightly became the celebrated capital of the Arabian Nights. With the availability of trained physicians two hospitals were then founded. One, rather short lived, was endowed by leading members of the generous Baramkids family[13] who amassed fabulous riches as vizirs and boon companions of the caliphs. After their fall in 803 this hospital apparently ceased to operate. The other, which has been more significant, was founded by the illustrious caliph Hārūn al-Rashīd (reigned 786-809) as a state hospital. It is reported that al-Rashīd charged the physician Jibrīl, a grandson of Jurjis, to supervise its establishment. In turn, Jibrīl selected the renowned teacher of medicine, translator, and author, Yūḥannā ibn Māsawayh, to become its chief physician.[14] This institution of al-Rashīd therefore should be considered the first real hospital to operate in Baghdād and the first ever to be established in the whole Islamic world.

No doubt the ninth century is regarded as one of the most glorious epochs in cultural activities under the Abbasid rule, in all fields of learning then known. In medicine, for example, a great part of the wealth of the Greek legacy was transmitted into Arabic. The number of educated physicians—among whom many were prolific writers on medical topics—not only multiplied, but their prestige reached such a height that Caliph al-Mu'taṣim valued his court-physician even above the chief justice.[15] This high standard was established by the physician-scholar, Ḥunayn ibn Isḥāq (810-873), and by others who not only excelled as accurate translators of medical works but who also raised the morals of physicians by strictly observing the ethical codes of the profession in teaching and practice.[16]

After the turn of the century it has been said that the hospital of Baghdād (not al-'Aḍudī hospital as some erroneously reported) was moved to a new and better location in the city. The same source[17] also indicates that the Caliph consulted al-Rāzī (865-925), the greatest clinician of Islam, as to where it should be built and asked him to become its director. Whether the story is true, we are not sure, but we have more reliable information that al-Rāzī taught medicine to a large group of students, and

[13] I found a brief reference to this hospital only by Ibn al-Nadīm, *Fihrist*, 356.

[14] Qiftī, *Ḥukamā*, 251; and Hāshim al-Watarī and Mu'ammir K. al-Sabandar, *Tārīkh al-Ṭibb fī al-'Irāq* (Baghdād, 1939), 37-38.

[15] Uṣaybi'ah, *Ṭabaqāt*, vol. 2, 106.

[16] Qiftī, *Ḥukamā*, 119-122.

[17] Uṣaybi'ah, *Ṭabaqāt*, vol. 2, 343-344; see also Ferdinand Wüstenfeld, *Geschichte der arabischen Aerzte und Naturforscher* (Göttingen, 1840), 40-41.

that at one time he headed the hospital of Baghdād as well as the one in his home town, al-Rayy.[18]

Soon thereafter the hospital of Baghdād was surpassed, or rather gradually superseded, by other newly erected hospitals. Famous among them are al-Sayyidah and al-Muqtadirī. It is of interest to note that both hospitals were founded in the same year, 918, and at the instigation of the court-physician Sinān ibn Thābit.[19] Al -Sayyidah Hospital, named after the mother of the Caliph who endowed it with 600 dinars (about $2850) a month, was built in "Sūq Yaḥya" on the Tigris river in the eastern part of Baghdād. Al-Muqtadirī, after Caliph al-Muqtadir (reigned 908-932), was located in the western part of the city. Sinān, who planned, directed, and appointed physicians for both hospitals, was also authorized by the Caliph in 931 to have the great honor of examining about 860 physicians of Baghdād and its vicinity. Only those found qualified were granted licenses to practise.[20] Sinān's contemporary, the physician Abū 'Uthmān Sa'īd ibn Ya'qūb of Damascus, was also charged by the same Caliph in 915 to assist in the supervising of hospitals, not only in Baghdād but in Mecca and al-Madīnah as well.[21] The latter two cities evidently were in need of medical supervision particularly during the pilgrim season when they were at their highest activity.

Fortunately, the rulers of new dynasties who came to power in this period endeavored to outdo their predecessors in constructing better public institutions such as mosques, schools, and hospitals. This was true of the illustrious king of the Buwayhid dynasty, 'Aḍud al-Dawlah (949-983), who was also a great champion of learning. About two years before his death 'Aḍud built al-'Aḍudī Hospital on the western banks of the Tigris.[22] This may rightly be considered the most glorious hospital ever built in Baghdād before modern times. It was furnished with the best equipment and supplies available for hospitals at that time. Twenty-four physicians were appointed to attend to its professional

18 Ibn al-Nadīm, *Fihrist*, 429-430; and Qiftī, *Ḥukamā*, 178.

19 It is of interest to note that Sinān aimed to raise public health conditions generally. Moreover, he was concerned not only about the welfare of the free inhabitants of Baghdād but for those in prison as well. He insisted on securing the best supplies for the hospitals and adequate medical care for prisoners who needed it. See Qiftī, *Ḥukamā*, 132-33. Sarton affirms that Sinān's main claim to fame "is his brilliant administration of the Baghdād hospitals and his efforts to raise the scientific standards of the medical profession." George Sarton, *Introduction to the history of science* (Baltimore, Maryland, 1927), vol. 1, 641.

20 Abū al-Faraj Bār Hebraeus, *Tārīkh Mukhtaṣar al-Duwal*, Ed., Anṭūn al-Ṣāliḥānī (Beirut, 1890), 281-282.

21 Sarton, *Introduction*, vol. 1, 631.

22 This took place forty years after the tremendous flood that destroyed a great part of Baghdād. See al-Watarī and al-Sabandar, *Tārīkh*, 39-41.

service. They called on the patients and prescribed for each his daily requirement of diet[23] and medication. Some of them took on the additional task of teaching "interns" and students of medicine.[24] We are not told, however, whether the famous physician al-Majūsī (Haly Abbas, d. 994) served at this hospital or not. But we are sure from al-Majūsī's own introduction to his book "al Kitāb al-Malakī" (Liber Regius) that he dedicated this encyclopedic medical work to his patron 'Aḍud, whom he probably continued to serve in Persia as court-physician until the patron's death.

Shortly after the middle of the eleventh century, the 'Aḍudī Hospital was destroyed in part by the Tigris flood. In 1068, we are told, the whole building was remodelled. Services for the patients were also improved, and the number of physicians was raised to twenty-eight.[25] Then about the middle of the twelfth century, a great figure in Arabic medicine, Hibat Allāh ibn al-Tilmīdh,[26] headed and taught in this institution and acquired high prestige throughout the area. Yet, when the traveller Ibn Jubayr visited Baghdād in 1184, although he admired the beauty of the hospital's construction, at the same time he pointed out deficiencies in the service and the attention paid to patients. Physicians, he reported, visited the sick twice a week only.[27] The 'Aḍudī Hospital continued to operate under difficult conditions thereafter, until finally it was destroyed at the fall of Baghdād in 1258 by invading Mongols under the leadership of Holagu, a grandson of Chingiz Khan. When the traveller Ibn Baṭṭuṭah arrived at the city in 1326, he mourned among other ruins the completely destroyed, once great hospital.[28]

By and large, it is safe to say that from the ninth century onward the importance of hospital services was recognized more than ever before, since they helped to promote public medical care not only in Iraq and Persia but in other parts of the Islamic world as well. Therefore, physicians became alert to better planning and operating of such institutions. Many authors have written

23 It might be of interest to note here that a list of drugs and diet used at the 'Aḍudī hospital was found preserved at the British Museum in a manuscript under No. OR,8293. See Cyril Elgood, *A medical history of Persia and the Eastern Caliphate*, (Cambridge, 1951), 181.

24 See Uṣaybi'ah, *Ṭabaqāt*, vol. 2, 232-35, 248, 344.

25 Elgood, *History*, 169-170.

26 Uṣaybi'ah, *Ṭabaqāt*, vol. 2, 268-72. See also Aḥmad ibn Khallikān, *Waāyāt al'Ayān*, (Cairo, 1885), vol. 1, 252-255; and 'Alī al-BayHaqī, *Tatimmat Ṣiwān al-Ḥikmah* (Lahore, 1933), 141-142.

27 Abū al-Ḥasan Muḥammad ibn Jubayr, *Riḥlāt ibn Jubayr*, Gibb Memorial Series vol. 5 (Leiden, 1949), 325-326.

28 Abū 'Abd Allāh Muḥammad ibn Baṭṭūṭāh, *Tuḥfat al-Nuzzār* (Cairo, 1871), vol. 1, 134.

on the subject, such as Abū Sa'īd Manṣūr Zāhid al'Ulamā (fl. 1040), who wrote a book on hospitals entitled *Kitāb al-Bīmāristānāt*.[29]

In 1048, Abū Sa'īd's contemporary, the studious physician Ibn Buṭlān, left his native city of Baghdād and travelled to Syria and Egypt and settled finally in Antioch (now in Turkey), probably to head its hospital which until then had been under the direction of the city's archbishop who prescribed diet and medication for the patients.[30] In the circumstances one might infer that the management of the hospital was greatly improved and possibly enlarged under the well-trained new director. Also the church might have approved and encourged Ibn Buṭlān in his new adventure, he being a member of its hierarchy as a monk. Schacht and Meyerhof affirm Usaybi'ah's report that Ibn Buṭlān engaged in building a new hospital in Antioch which he directed until his death.[31]

In other parts of Syria and Palestine there was a challenge to establish more and better hospitals during the period of the Crusades. Contact between East and West in this bitter conflict produced a remarkable increase in medical care.[32] Thus, for example, the greatest hospital ever built in Damascus during the Middle Ages was al-Nūrī, completed in 1156. It was named after its founder, the energetic Turkish King Nūr al-Dīn Zinkī. Under the direction of the physician Abū al-majd al-Bāhilī, Nūr al-Dīn equipped the hospital with adequate supplies of food and medication. He donated in addition a large number of medical books to be housed in a special hall serving as a library. There, also, teaching and discussions on topics related to medicine were conducted.[33] Ibn Jubayr in 1184 praised Damascus as one of the friendliest places he had ever visited and said that it "surpasses all other cities in its beauty . . . the paradise of the Orient." In describing al-Nūrī Hospital, he admired the way in which the administrator kept a register of the patients,[34] probably the earliest

[29] Earlier, al-Rāzī wrote *Kitāb Ṣifat al-Bīmāristān*, on the description, services and qualification of the hospitals. Uṣaybi'ah, *Ṭabaqāt*, vol. 2, 257-258, 361. Al-Rāzī also referred repeatedly to "the hospital experiments," where he applied his methods of treatment as reported in his *Kitāb al-Ḥāwī fi al-Ṭibb* (Hyderabad, Deccan, 1955), pt. 1, 36 and pt. 2, 189.

[30] Ibid., 238-242, and Qiftī, *Ḥukamā*, 192-195.

[31] Joseph Schacht and Max Meyerhof, *The medico-philosophical controversey between Ibn Buṭlān of Baghdād and Ibn Riḍwān of Cairo* (Cairo, 1937), 14.

[32] In like manner, the Arabs earlier gathered Greek manuscripts as their booty from the Byzantines in a war waged on the frontiers (829-838). The wealth of this cultural material when translated into Arabic helped to advance learning in Islam.

[33] Uṣaybi'ah, *Ṭabaqāt*, vol. 3, 256-257.

[34] Ibn Jubayr, *Riḥlāt*, 283-284.

of its kind in the history of hospitals. Beside each name the physician daily listed the patient's requirement of diet and medication after he had made his rounds. Such hospitals, Ibn Jubayr concluded, "are one of the great glories of Islam."[35] Their good reputation attracted many eminent physicians to work in them. Muhadhib al-Dīn Ibn al-Naqqāsh (d. 1178) headed the al-Nūrī Hospital besides serving King Nūr al-Dīn as chief physician. His son Najm al-Dīn served in the same hospital, then was promoted to the rank of Vizir for the Ayyubids. Early in the thirteenth century al-Dakhwār first served in al-Nūrī Hospital at a low salary. Then, as he increased in fame, his income from private practice brought him much wealth and he started a medical school in the city. Among his well-known students[36] are Ibn Abī Usaybi'ah (1203-70), the famous medical historian whose work has been quoted repeatedly in this article, and 'Alā al-Dīn ibn al-Nafīs (d. 1288) whose discovery of the lesser circulation of the blood[37] marked a new step in better understanding of human physiology and was probably the earliest explanation until William Harvey (1628).

In the following century al-Qalqashandī (1355-1418) affirms that the administrator of al-Nūrī Hospital in his time was given, as a token of his prestige, a title of honor, Shihāb al-Dīn. He was authorized to exhort the employees to render better service to the patients and each department to execute its duties faithfully and efficiently.[38] It is worth noting that fragments of the original building of this hospital which served in promoting public medical care for about seven centuries remain to this day.

In Jerusalem, in the quarter presently known as al-Dabbāghah, the order of the Hospitallers of Saint John founded a hospital shortly after the middle of the eleventh century. They were able to do this through aid from the merchants of Amalfi. By the end of that century it grew into a great establishment which had in addition three beautiful churches, a palace for the knights, and a convent for the nursing sisters. Medical activities in the hospital were tremendous because of the large number of patients

35 *Ibid.*

36 Usaybi'ah speaks highly of his teacher, al-Dakhwār, and his method of teaching in this late flourishing period of cultural activities in Arabic history. See *Ṭabaqāt*, vol. 3, 267, 303-304, and 390-398.

37 Max Meyerhof, "Ibn An-Nafīs (XIIIth cent.) and his theory of the lesser circulation," *Isis*, 1935, *23*, 112.

38 Aḥmad al-Qalqashandī, *Ṣubḥ al-A'shā* (Cairo, 1918), vol. 12, 84-85.

admitted daily[39]—residents, sick pilgrims, and wounded soldiers. After Jerusalem surrendered to Salāḥ al-Dīn (Saladin), he transformed the building in 1187 into a center for the teaching of Islamic religion and enlarged the hospital which he then called al-Ṣālihānī after himself. He appointed physicians to attend to the hospital, prominent among them being Ya'qūb Ṣaqlān al-Nasrānī, whose ancestors came originally from al-Balqā district of Transjordan.[40] It may be of interest to add that this hospital which later on passed into a period of decay was completely destroyed in 1458 by earthquake.[41]

Leclerc points out the fact that the development of hospital management in Egypt lacks certain characteristics which predominated in Iraq and Syria. In Egypt, for example, we do not encounter as many eminent physicians associated with the same institution at one time as we found in the Baghdād or al-Nūrī Hospitals. Nor were these eminent physicians ever called upon to act as inspectors or supervisors of professional practice.[42] This was the case at least up to the twelfth century.[43] Nevertheless, other areas of no less significance were emphasized or utilized, as will be recognized from the early construction (872) of the hospital at al-Fusṭāṭ by Aḥmad ibn Ṭūlūn.[44] This institution, which served Cairo's growing population for almost six centuries, was the first we know of in Egypt to play such an important role.[45] The halls were divided into separate wards according to sex and with regard to the kind of illness or the surgical operation. Two separate baths were installed, one for men and another for women. After admission, each patient was required to wear special apparel provided by hospital authorities, while his personal clothes, money

39 For more detail regarding the contributions and activities of the Hospitallers, the reader may wish to consult Edgar E. Hume, "Medical Work of the Knights Hospitallers of Saint John of Jerusalem," *Bull. Hist. Med.*, 1938, *6*, 399-405.

40 Qifṭī *Ḥukamā*, 248.

41 'Isā, *Bīmāristānāt*, 231-232.

42 Lucien Leclerc, *Histoire de la médecine arabe* (Paris, 1876), vol. 1, 568.

43 Here we should note, however, that during the twelfth and thirteenth centuries, medical activities in Egypt became more organized and exhibited a new vigor. Al-Shaykh al-Sadīd (fl. 1140 to 1175), a celebrated physician of Cairo and a junior contemporary of Ibn al-Tilmīdh of Baghdād (d. 1165), served five Fatimid Caliphs as Court-Physician and head of Cairo's practitioners. There also, the famous physician and philosopher, Mūsā ben Maymūn (1135-1204), known as Maimonides, attained a high reputation. In early thirteenth century 'Abd Allāh ibn Aḥmad Ib nal-Bayṭār (d. 1248) was appointed chief herbalist in Cairo by al-Malik al-Kāmil.

44 Aḥmad ibn Ṭūlūn was the founder of the Ṭūlūnid dynesty (870-904) under whose reign Egypt enjoyed a golden age of cultural and economic achievements. For further detail see Philip K. Hitti, *History of the Arabs* (London, 1958), 452-455.

45 Two other smaller hospitals prior to Ṭūlūn's of minor importance and of which little is known were reported by 'Isā, *Bīmāristānāt*, 66-67.

or valuables were kept in a safe place until the day of his discharge.[46]

The greatest example of Arabic architecture that comes down to us from thirteenth century Egypt is the famous al-Manṣūrī Hospital. It was built in 1285 by king al-Manṣūr Qalāwūn, and an interesting story is told as the reason for its erection. When Qalāwūn, being then a captain, fell sick during the campaign of his army in Damascus, he was given free treatment at the al-Nūrī Hospital. On recovery, Qalāwūn vowed that he would build a great hospital in Cairo if he ever sat upon the throne of Egypt. At the dedication ceremony he asked for a cup of wine from the well-stocked pharmacy shop at the hospital. After drinking it, he declared that by taking this potion as a medication he was signifying that this hospital was dedicated to serve all who needed medical care—from the king on the throne to the least among his subjects whether rich or poor, young or old, male or female.[47]

In addition to a medical library and a lecture room, the hospital included a dispensary and a store room in which prepared drugs such as syrups, electuaries, eye lotions and salves, suppositories and medicinal herbs were kept. Beside staff members entrusted with hospital funds, expenditures, and management, there were employees to clean the wards, care for the sick, and to work in the well-equipped kitchen. Patients able to leave their beds were allowed to respond to the Mu'adhdhin's call summoning the faithful to prayer and to the chanting of religious songs and melodies. There were also readers of the Quran and teachers in Islamic tradition to minister to the patient's spiritual needs.[48] These extra features which involved many additional expenses were included because of the awareness of the great role played by hospitals in promoting public health and the high prestige acquired by the physicians, pharmacists, and administrators associated with them.

Four decades after the construction of al-Manṣūrī hospital in Cairo, Ibn Baṭṭūṭāh visitted it and was overwhelmed by its grandeur. He also praised the efficiency of its administration made possible by adequate funds for hospital needs and expenses.[49]

Meyerhof considered the founding of the al-Nūrī Hospital in Damascus and al-Manṣūrī in Cairo to be the most significant

46 Maqrīzī, *Khiṭaṭ*, 2:405.

47 *Ibid.*, 406-7; and Prisse D'Avennes, *L'Art Arabe d'Après les Monuments du Kaire* (Paris, 1877), vol. 1, 136-139.

48 *Ibid.*

49 Ibn Baṭṭūṭāh, *Tuḥfat*, 19-23. See also Dieter Jetter, "Zur Architektur islamischer Krankenhauser," *Sudhoffs Arch.*, 1961, *43*, 261-273.

accomplishments of Arabic medicine of the time, and a probable influence on those thirteenth century hospitals in the West which featured some secular control.[50] Returning to al-Manṣūrī Hospital, it is of interest to note that it continued to operate until modern times. In the nineteenth century its wards were reported to be adequate to accommodate one hundred patients.[51] This was followed by a period of decay. Its activities, however, were revived during the second quarter of this century when it was used as an ophthalmic hospital.[52]

Let us now turn to the Arabic Maghrib in North Africa and al-Andalus in the part of the Iberian peninsula that was dominated by the Muslims. It is probable that the first hospital in that part of the Islamic world was founded about 830 in al-Qayrawān, the capital of Afrīqiyah (Tunisia today), by the Aghlabid prince Ziyādat Allāh I (reigned 817-838). It was called the Dimnah Hospital, being built in al-Dimnah quarter near the great mosque of Qayrawān. Consequently, other hospitals which were erected thereafter in Tunisia were likewise called Dimnah instead of the popular "bīmāristān." The construction of al-Dimnah in Qayrawān was simple but adequate, and the halls were well organized to include waiting rooms for visitors, a chapel for worship and religious teaching, and a special bath which in Islamic tradition can be used for washing prior to prayer. In addition to regular physicians who attended the sick, there were "Fuqahā al-Badan,"[53] a group of theologians who practised medicine as well, a token of the early scholastic movement especially in the peripheral states of the Islamic world. Their medical services included bloodletting, bonesetting, and cauterization. Sudanese women were employed to serve in the wards and among the patients as nurses. Near al-Dimnah hospital there was a separate building called "dār al-Judhamā" (the house of the lepers) where lepers were confined for medical care. These hospitals in Tunisia were supported by the rulers from the state treasury and by other philanthropists who gave generously to boost hospital income so that the best care might be provided for the patients.[54]

50 Meyerhof, "Ibn An-Nafis," *Isis*, 1935, 23, 103, and "Science and Medicine," in *Legacy*, 349-50; and "Arabian pharmacology," *Ciba Symposia*, 1944, 6, 1866.

51 J. J. Marcel, *Précis historique et descriptive sur le Moristan an Caire* (Paris, 1883), 28.

52 Naguib Mahfouz, *The history of medical education in Egypt* (Cairo, 1935), 10-12.

53 Ḥasan 'Abd al-Wahhāb, "al-Ṭibb al-'Arabī fī Ifrīqiyah," *al-Fikr*, 1958, vol. 3, no. 10, 907-916.

54 *Ibid.*

It may be of interest to mention here the great hospital built in Morocco about 1190 in the capital city of Marrākesh by the Muwaḥḥid ruler ala-Manṣūr Ya'qūb ibn Yūsuf (1184-1199). The hospital was erected in a spacious area surrounded by fruit trees, flowers, herbs, and vegetables, according to the historian al-Marrākushī who was an eye witness of its construction. "Water" he added, "was brought in aqueducts to all its sections, besides four pools in the center thereof, of which one was built of white marble." The daily endowment was thirty dinars (*ca.* $142.50) for the purchase of food, unstocked medication, and unpredicted expenses. At this hospital, the physicans carried out their daily work of caring for the sick and prescribing their diet and medications, while appointed pharmacists (ṣayādilah) specialized in the compounding and preparing of drugs. This reference to the position and duties of a well-trained class of pharmacists is of special interest to the history of hospital pharmacy in Morocco as it was the only such reference encountered in this survey. It points to the fact that pharmacists of high caliber and efficiency existed in Morocco at this time. Here again, al-Marrākushī explains, patients were provided with special apparel for the summer and winter seasons.[55]

After the elaborate records concerning hospital construction throughout the Arabic states, it seems astonishing that information regarding their rise in al-Andalus (the part of the Iberian peninsula then under Islamic rule) is meager indeed. As a matter of fact, although private out-patient clinics were reported from the early tenth century at the residences of renowned physicians,[56] we have to wait four more centuries before coming to conclusive evidence of actual hospital installations in al-Andalus. This is the more surprising when we realize that from the tenth century Spain produced many eminent scholars in the medical field competent to carry out such tasks efficiently. It has been reported, moreover, that in 958 Muḥammad ibn 'Abdūn al-Jabalī left his native country of Spain for several years to travel in the East in order to further his experience and knowledge. He visited first Baṣrah in Iraq, then Cairo in Egypt where he practised at its hospitals and excelled over many of his co-workers. When he returned to Cordova in 971, he served Caliph al-Ḥakam II as

[55] 'Abd al-Waḥīd al-Marrākushī, *al-Mu'jib fī Talkhīṣ Akhbār al-Maghrib*, R. Dozy, Ed. (Leiden, 1881), 208-210.

[56] Sulaymān ibn Ḥassān ibn Juljul, *Ṭabaqāt al-Aṭibbā wa al-Ḥukama*, Fuad Sayyid, Ed. (Cairo, 1955), 97, 112-113.

court physician.[57] We have, however, neither indication that he worked in a hospital there, for which his training qualified him, nor that he established any hospital in the once great capital of the Umayyads in Spain. Over two centuries later, Abū Isḥāq Ibrāhīm al-Dānī of Bougie, to whom Leclerc refers,[58] served in the Marrākesh hospital already mentioned, and not in Spain as supposed by Leclerc. His two sons also served in the same hospital. Later the elder, Muḥammad, was killed in Spain when King al-Nāṣir al-Mawaḥḥid was defeated[59] in 1212 by Alfonso VIII, King of Castile.

The greatest hospital established by the Muslims in Spain, and probably the only one built in that part of the country under Islamic rule of which we now have definite knowledge, was that of Granada. It was founded in 1366-1367 by Prince Muḥammad ibn Yūsuf ibn Naṣr[60] in this last Islamic Spanish capital which grew during the Naṣrid dynasty into a metropolis of almost one half million population. An Arabic inscription on the preserved marble monument of the hospital indicates clearly that this feat was unprecedented in the whole history of Islamic domination in Spain.[61] It is worth noting that this installation continued to operate for the care of the sick until the fall of Granada, the last hold of Islam in Spain, in 1492.

This brief presentation of the story of hospitals in Islam reveals some unusual facts regarding their rise in Arabic states and their development which surpassed all previous accomplishments of the kind in recorded history. However, we must confess that hospitals were known much earlier, but, unlike those in Islam, they were generally under the supervision of religious orders of various kinds. For example, in ancient Mesopotamia and Egypt, medical practice in temples and elsewhere reflects the fact that care for the sick was mainly the privilege of the priest-physician. In Greece, Asklepius replaced Imhotep of the Egyptians as the god of healing. Centers for curing the sick were named Asklepieia (sing. Asklepieion) after him. These centers soon spread throughout the islands and mainland of Greece. By far the greatest among them was that at Epidaurus, south of Corinth. Other Asklepieia were founded in Athens (about 420 B.C.) Cos, Cnidus, Pergamus,

[57] *Ibid.*, 115.
[58] Leclerc, *Histoire*, vol. 1, 571.
[59] Uṣaybi'ah, *Ṭabaqāt*, vol. 3, 128.
[60] Lisān al-Dīn ibn al-Khaṭīb, *al-Iḥaṭah fī Akhbār Gharnāṭah* (Cairo, 1319 A.H. [1901 A.D.]), vol. 2, 29.
[61] See also E. Lévi-Provençal, *Inscription arabe d'Espagne* (Paris, 1931), 164.

and in the late third century B.C. in Rome. Here patients were brought to the temple to stay overnight. The proper remedies were revealed to the priest in a dream. The sanctuary, prayers, and incantation were also thought of as an integral part for achieving cure.[62]

In the Roman period thereafter, houses of health each comprising a hospital and dispensary were called Iatreia (sing. iatreion). In one that dates back to 79 A.D., the year when Pompeii was buried under ashes from the eruption of Vesuvius, surgical instruments have been discovered. Also the Roman army in their campaigns on the frontiers of what we know today as Germany and France founded special edifices wherein the sick were received for treatment. Each *valetudinarium,* as they were called, was rectangular in shape. Two at least were known to have existed in the second century. But the one better identified is that of the camp at Neuss, near the Rhine and opposite Düsseldorf, where surgical instruments and an ointment jar have also been discovered.[63]

During the fourth century, establishments for the aged, the sick, the stranger, and the leper were reported in the Byzantine Empire. Their number multiplied in the following centuries, especially those of the resthouse type, for the above-named groups of needy people. These institutions were analagous to the *valetudinaria* of the Roman army and have since the fourth century influenced similar establishments, the hospices, in the West.[64] It is possible that the first "house for the sick" in Islam instituted by al-Walīd (see p. 367) was the product of direct Byzantine influence. But one of the greatest Byzantine hospitals prior to the twelfth century was that of the Pantocrator monastery (named after Christ, the All-Ruler, the Omnipotent), endowed generously by John II in 1112. This charitable institution shows how Byzantine medicine was at its best in the organization of hospitals.[65] On its staff there were male and female doctors, surgeons, nurses, assistants, and servants. The patients were admitted into separate wards in accordance with the kind of illness and sex.[66] We have already seen similar developments in Islam. In the latter, how-

62 Ernest Wickersheimer, "Les Edifices Hospitaliers à travers les âges," *Conférence Faite au Palais de la Découverte* (Paris, 1953), [5]-6.

63 *Ibid.*, 7-9.

64 George Schreiber, "Byzantinisches und abendländisches Hospital," *Gesammelte Abhandlungen, Gemeinschaften des Mittelalters* (Münster, 1948), vol 1, 35-36.

65 *Ibid.*, 10-19, 26-40.

66 *Ibid.*; and Runciman, *Byzantine civilization,* 238-239.

ever, we did not encounter any women doctors associated with Islamic hospitals.

During all this period monastic infirmaries and hospices in the West, like those in the Byzantine Empire, were generally under direct control of the clerical class.[67] Nevertheless, quite a few of these hospices helped to keep medical practice alive through these centuries and paved the way for the rise of greater hospitals in th late Middle Ages. For example, the celebrated Hôtel-Dieu in Paris goes back in its history to the eighth century if not earlier. P. Jang describes and draws a careful and lucid diagram of the plan of construction of a remarkable hospital (including a separate dispensary) as early as 820, in connection with the renowned Saint-Gall Abbey[68] in modern Switzerland.

But as has been mentioned earlier, hospitals in Islam generally were under secular authority. Physicians, surgeons, and pharmacists associated with the hospitals, as well as those in management and labor, were all from the laity. Even more remarkable is the fact that Christian physicians who belonged to the Eastern churches were employed together with other non-Muslim minority groups on an equal basis with their Muslim colleagues in these institutions. They performed commendable services according to their qualifications as members of the health profession and received no discrimination on account of their faith—another token of the tolerance that characterized the reign of many caliphs during this period.

We should admit, however, that religious aspirations did play an important role in reshaping the outcome, since Islamic tradition from the beginning was in favor of medical practice. It emphasized the importance of bodily cleanliness and the necessity of seeking medication for every disease. So when the time was technically ripe for the rise of hospitals, they were generously endowed by state rulers. The best examples are the caliphs who bestowed high honors on competent physicians whom they also appointed to head, and in some cases even to plan the construction of, such institutions. This enhanced the prestige

[67] Loren C. Mackinney, *Early medieval medicine with special reference to France and Chartres* (Baltimore, Md., 1937), 74-76, 101-102, 149. A. G. Ives, in *British Hospitals* (London, 1948, pp. 9-10), states that "throughout Christendom, the provision of hospitals for the sick and destitute had long been accepted as an obligation both by the official hierarchy of the church and by the monastic orders." Ives also reports that in the late sixth century the numerous existing infirmaries formed a part of the monastic institutions.

[68] This plan was briefly presented by Wickersheimer, "Hospitaliers," *Conférence*, 12-14.

not only of those renowned physicians but of the hospitals and the profession as well. It was also in line with the policies and high aims of these Muslim leaders to provide the best for their people. They boasted of participating in these installations. Moreover, alms-giving (al-Zakāh) in Islam is as important a phase of the religion as are prayer, fasting, and pilgrimage, and hence the duty of all physically able Muslims regardless of their social status. Caliphs and rulers welcomed the opportunity to build new hospitals adequately equipped in order to give an expression of the immense riches and grandeur of their regimes as well as to fulfil this religious command in the best and most useful manner.

Thus religious enthusiasm could be shown as philanthropic effort to alleviate the suffering of the sick and to comfort the unfortunate. Rulers who were looked upon as defenders of the faith emphasized spiritual guidance to uplift the morale of their people. They paid visits to the patients not only to show them kindness and sympathy but also to insure for them the best attention from hospital employees and physicians alike.[69] As a result, religious activity within the hospitals was greatly appreciated and encouraged in spite of the fact that these institutions operated under secular management.

In addition to the religious satisfaction, hospitals being among the best endowed public institutions, such philanthropy secured for caliphs and others in power the support of their people. The importance of this point increased in magnitude in countries of continued unrest where the rulers always sought to win the loyalty of their subjects, who alone could save their thrones in the face of hostile circumstances. Therefore in this unquiet race for power each ruler tried his best to establish during his reign a golden age wherein social justice and prosperity would be achieved. Public institutions such as hospitals were among the best thought-of to help reach such goals. They generated immediate public contentment and applause, plus constituting great feats which placed the names of their founders among the immortals. Acknowledgments were always made to these founders who were called "guardians of science and learning" and "executors of justice, the defenders of the poor and the princes of the faithful." Similar cases can be found even in modern times in various parts of the Middle East, all this in spite of the fact that

[69] Uṣaybi'ah, *Ṭabaqāt*, vol. 1, 1, 221; and Qifṭī, *Ḥukamā*, 193-194.

such institutions are still practically financed from the state treasury and only with the aid of the ruler.

Up to the thirteenth century in Islam large cities grew by leaps and bounds. There was then nothing of the kind in the Christian West except Constantinople. But these prosperous crowded centers had their problems: the rise of a poorer class, the spread of disease, and the urge for social reform and public health improvement. More hospitals were needed in these heavily populated areas. There was also a demand for medical care for people in rural districts and even jails, which was not ignored.[70] Thus a remarkable awareness of the importance of improving conditions related to public health was in the making, and this has certainly been a contributing factor in the development of hospitals —many of which became known immediately after this period as houses of healing (sing. dār al-Shifā).

It has already been mentioned that hospitals became centers for schools of medicine where students could be trained and novice practitioners gain experience. Lectures and discussions on medical topics based mainly on theoretical interpretation of classical and Arabic medical writings were also conducted in them. These hospitals thus rendered a great service in keeping alive and in reviving medical knowledge. They were modelled after the original medical school and hospital at Jundī-Shāpūr but later themselves became models for hospitals erected in the West during the late Middle Ages.

The financial needs, as records indicate, were met by endowments from rulers and philanthropists. No sooner did these hospitals progress in their medical activities than they also acquired an added source of income, the "waqf," which constituted public properties that were utilized by such institutions as hospitals and mosques. The revenue from the "waqf" was used to promote the welfare of the citizens. As a result, hospitals provided free medical services to all, regardless of age, sex, or social status. Yet in reality, a great segment of the population, especially those who could afford it, preferred to consult the doctor of their choice and pay the required fee. No doubt this gave the poor, the aged, and the seriously or chronically ill more access to hospital treatment. Thus when the endowment was generous and the "waqf" secured good income, then better medical services were rendered to a greater number of people. This was true in the prosperous

70 Qifṭī *Ḥukamā*, 130-132.

centers which supported such philanthropic collective efforts to care for the sick within their boundaries. When a hospital's income fell below operating expense or when methods of spending accumulated funds were abused, then medical services were reduced in proportion. But on the whole, the larger hospitals were in good condition financially, and their patients enjoyed fine medical care, a healthy environment, and good meals and service.

Turning to organization, it is fairly safe to say that hospitals were operated in a way similar to that of other public establishments such as mosques, courts, and schools. The state ruler would appoint the director of the hospital who in turn selected his medical staff with the ruler's approval. The administrator in hospital management also selected his aids and the labor needed for the various functions of the hospital, the kitchen, and the "waqf." Pharmacists were apparently considered among the medical staff, although the pharmacy needs were filled through what we may call today a supply division, as the case is in several modern hospitals.

Medical treatment offered in these hospitals under Islamic rule might be considered here under the four following categories:

1. Therapy by exercises, baths, and similar physical treatments was encouraged and carried out during this period.

2. Diet was also one of the first concerns of most practitioners of the time. They emphasized the idea that if diet alone could be sufficient to restore health, then the practitioner should avoid the administration of drugs.[71] The whole approach was based on the humoral theory and degrees of qualities introduced by Hippocrates and elaborated upon by Galen in classical writings. Similarly, Byzantine medicine as well as that of the West followed the same line of reasoning.

3. When special diet was not by itself sufficient, then simple remedies from the then comprehensive Arabic materia medica were used, including drugs from the three "kingdoms": plant, animal, and mineral. If simples were not capable of inducing cure, then compounded drugs were resorted to by necessity.

[71] The preference of diet over drugs in medical treatment was emphasized by al-Rāzī in more than one place in his writings. Al-Majūsī (d. 994), Ibn al-Jazzār (d. 1009), Abu al-Qāsim Zahrāwī (d. *c.* 1013) and many other eminent physicians in Islam propagated the same concept. See 'Alī ibn 'Abbās al-Majūsī, *Kāmil al-Ṣinā'ah al-Ṭibbiyyah* (Cairo, 1294 A.H.), vol. 2, 15-16. This concept, however, did not prevent them from using compounded drugs extensively.

4. In most cases, only when drugs failed to bring relief was surgery undertaken.[72] Anatomical knowledge on the whole was based on Greek contributions to the field, especially the writings of Galen which were translated into Arabic during the ninth century; human dissection was avoided by even the most qualified physicians of this period in Islam due to traditional, religious, and moral restrictions.[73] Nevertheless, it is now well known that highly trained doctors and oculists skilled in surgical manipulations did work in hospitals as permanent staff members. For example, Abū al-Khayr al-Jarayiḥī who acquired a good reputation in medical practice was appointed by king 'Aḍud al-Dawlah as chief surgeon in his newly founded hospital.[74] Predominant among surgical operations then used were cautery, venesection, bone-setting, binding up of wounds, incising of abscesses, circumcision, and minor eye surgery. In general, after 1000 A.D., anatomy and surgery in Islam advanced but little until almost the middle of the thirteenth century when Ibn al-Nafīs (d. 1288/9) made his great contribution towards the discovery of the lesser circulation and the physiological function of the heart. Ibn al-Nafīs, as predecessor to the famous Arabic surgeon al-Zahrāwī in Spain (d. *ca.* 1013), showed great concern over the low status which surgery had reached in his time due to ignorance of anatomical knowledge and lack of originality.[75] It had in fact fallen into the hands of charlatans and uncultured practitioners whose only aim was material gain and not the public interest.

Here one might ask concerning childbirth in Islamic hospitals. As far as I have been able to find out from contemporary sources, there were no "maternity" wards directly connected with hospital services. Delivery in Islamic lands was almost totally confined to homes rather than hospitals, as was the case in these areas up to recent years. Delivery was accomplished with the help of midwives because of religious sentiments and social considerations. Many midwives, however, of whom quite a few were well trained in their profession, carried out their duties, especially the difficult cases, under the supervision of the physician or surgeon and his continued advice. Al-Zahrāwī in *Kitāb al-Taṣrīf* devotes a com-

72 Recommendations for use of drugs instead of surgery were explicitly expressed by Abū al-Qāsim al-Zahrāwī in several passages of his surgical treatise. See, for example, Johannis Channing, *Albucasis de Chirurgia Arabice et Latine* (Oxford, 1778), 12-13.

73 The two great surgeons of Islam, al Zahrāwī and Ibn al-Nafīs (d. 1288/9), confessed such restrictions in the introduction to their surgical writings.

74 Qifṭī *Ḥukamā*, 265-266; and Elgood, *History*, 162.

75 Channing, *Albucasis*, 2-6.

plete chapter to discussing the duties and responsibilities of the midwife and giving professional advice and intelligent instructions,[76] which among other things proves the extent of his interest in this branch of the medical field and the frequency with which he was consulted on such matters.

Hospitals in Islam, although they did not devote any part of their activities to childbirth, nevertheless gave great services to growing children and adults, to the aged, and to the infirm who needed urgent or constant medical care. And in their accomplishment they filled a gap in promoting public health generally and in raising the standard and quality of the medical profession during this period of Islamic civilization.

[76] *Ibid*, 321-326.

Iconographic Origins of Some Early Anatomical Diagrams: A Further Suggestion

L. H. WELLS*

SOME fifty years ago Sudhoff advanced the view that a medieval series of conventional anatomical diagrams (the "five-picture series"), which can be traced through several centuries of manuscript tradition, is derived from a classical Alexandrian source. These diagrams depict very crudely the major systems of the body on full-face figures in a straddled or semi-squatting posture. The earliest European examples identified by Sudhoff date from the twelfth century (Fig. 1A). A parallel series of diagrams appears in Persian manscripts from the end of the fourteenth century onwards[3]; in most respects these are closely comparable with the early European examples, but in the Persian figures the hands are often placed on the knees or in front of the thighs (Fig. 1B).

In a previous paper[9] I have suggested that a medieval diagram representing the visceral anatomy of a pregnant woman was based on figures representing a goddess of fecundity which were current in Egypt during the Ptolemaic and Roman periods (*ca.* 300 B.C. –300 A.D.). I now think it possible to develop this argument further and to derive the male figures of the five-picture series also from an Egyptian iconographic source, the figure of the popular god Bes, represented as a corpulent dwarf with bowed or straddled legs and a mask-like animal visage, and very often with arms akimbo (Fig. 1C). In drawings and reliefs the figure of Bes, by an extremely unusual departure from the normal conventions of Egyptian art, is represented full-face and presents an outline very similar to those of the five-picture series. Figures of Bes often show vigorous anatomical modelling; a small example in ivory, illustrated by Maspero[5], which it has not been possible to reproduce, has the lower ribs and xiphisternum strongly emphasized, curiously resembling some examples of the five-picture series.

On late Egyptian monuments, figures of Bes are sometimes juxtaposed with the figure or head of the goddess Hat-hor, to whom

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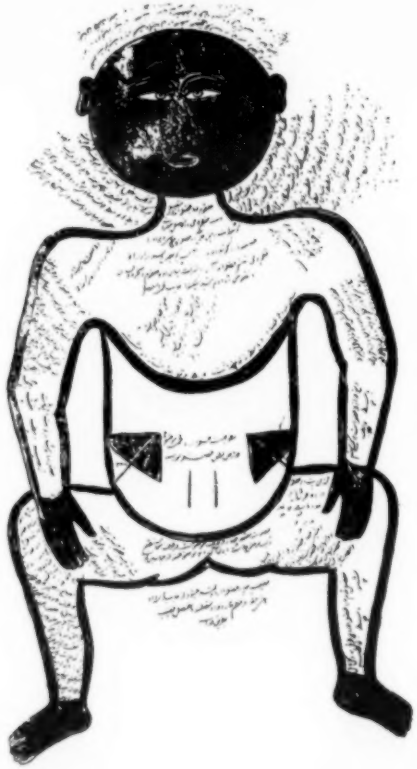
phallic offerings were made for fertility under the Eighteenth Dynasty.[4] According to Hornblower, the figure of Bes was associated with aphrodisiac or fertility magic. A blue-glazed faience figurine, found in Cyprus[7] but possibly of Egyptian origin, which represents Bes seated on the shoulders of an obese and bow-legged nude female figure, may belong to this context. It has a counterpart in an Egyptian bronze statuette representing Bes seated on the shoulders of an achondroplastic dwarf;[2] Dawson, noting that achondroplastic dwarfs had magical significance, mentions particularly a spell to facilitate birth, which is to be said four times over a dwarf of clay placed upon the forehead of the woman who is giving birth. On the panels of beds from the Eighteenth Dynasty royal and noble tombs, the figure of Bes is juxtaposed with that of the birth goddess Ta-urt; a remote relationship between some representatives of Ta-urt and the prototype of the medieval pregnancy diagram was suggested in my previous paper. I suggest, therefore, that the associated figures of Bes as a fertility god and of a fertility or birth goddess provided the iconographic foundation upon which the anatomical diagrams of the five-picture series were constructed.

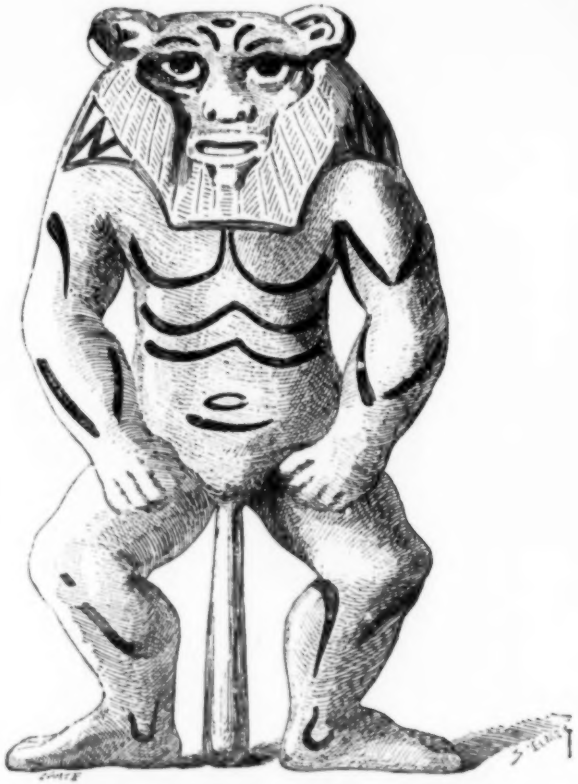
The figure of Bes was diffused, among other products of Egyptian imagery, to Phoenicia and Syria and to places under Phoenician influence, such as Cyprus. Since the "Baubo" type of goddess figure also existed in western Asia, it is conceivable that these figures might have been adapted for anatomical purposes during the Hellenistic period in Syria (e.g., at Antioch) or even in Cyprus. Nevertheless, since Alexandria was the principal center of late classical anatomy, Sudhoff's view that the five-picture series originated there still seems most probable.

The gap between the earliest known European examples of the five-picture series and their presumed classical prototypes still remains to be filled; it does not seem that the oriental tradition represented by the extant Persian examples can be used to bridge this gap. In my previous paper I remarked on the Dark Age or early medieval "Sheila-na-gig" figures of the British Isles as parallel and possibly related iconographically to the medieval pregnancy-figure; as a further pointer in the same direction may be noted a Bes-like squatting nude male figure, a sort of male Sheila-na-gig, in the margin of the Bayeux Tapestry.

A. Skeleton figure of five-picture series from Prüfening MS. of 1158 A.D. (From Sudhoff, 1907.)



B. Muscle figure of five-picture series from Persian MS. (After Sudhoff, from Choulant-Frank, 1920.)



C. Egyptian figure of Bes, glazed earthenware. (From Perrot and Chipiez, 1882.)

FIGURE 1

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Studies in the History of Dental Histology

I. Anders Adolf Retzius and Alexander Nasmyth: A Correspondence Between Two Great Nineteenth Century Dental Histologists

JENS J. PINDBORG*

THE years between 1830 and 1840 brought many new discoveries in the field of dental histology. Independently working with almost the same problems were Johannes Evangelista Purkyně, Meyerus Frænkel, Isaacus Raschkow in Breslau, Joseph Linderer, Johannes Müller, and Theodor Schwann in Berlin, Alexander Nasmyth, Richard Owen, and John Tomes in London, and Anders Adolf Retzius in Stockholm. In 1836, Retzius published his results in Swedish in the *Transactions* of the Royal Academy of Science in Stockholm.[1] A German translation appeared in 1837 in Müller's *Archiv*.[2] In England Alexander Nasmyth read Retzius' paper and in 1839 included some references to it in his *Researches on the Development, Structure, and Diseases of the Teeth*. Nasmyth forwarded a copy[3] to Retzius inscribed with "profound admiration" together with a letter. This letter, dated 30 May 1839, and not previously published, is an interesting contribution to the history of dental histology. It was found in the Library of the Royal Academy of Science in Stockholm[4] and, with permission from the Library, is reproduced here:

London, 13. A. George Street Hanover Square
30 May 1839.

Dear Sir,

May I beg your acceptance of the accompanying little work, being the commencement of a series of parts on the general subject of the teeth. The Structure of which you have so ably investigated. I hope you will excuse the

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1 The title of Retzius' original Swedish report is "Mikroskopiska undersökningar öfver Tändernes, särdeles Tandbenets struktur" published in Stockholm in 1838 in the *Kongliga Vetenskapsakademiens Handlingar* for 1836, pp. 52-140.

2 The title of the German translation is "Bemerkungen über den innern Bau der Zähne, mèt besonderer Rücksicht auf den im Zahnknochen vorkommenden Röhrenbau, von A. Retzius; mitgetheilt in Briefen an den Dr. Craplin in Greifswald; aus dem Schwedischen übersetzt von dem Letztern." *Arch. Anat. Physiol. wiss. Med.*, 1837, pp. 486-566, 2 pl.

3 The book is now in the Library of the Caroline Institute, Stockholm. (Published in London, J. Churchill, 1839. xvi, 165, 3 pp.)

4 The largest collection of correspondence to and from Retzius is in the Library of the Royal Academy of Science in Stockholm. A smaller collection is located in the Library of the Caroline Institute, Stockholm.

remarks I have thought myself bound to make in regard to some points which I consider worthy of still more extended investigation, and ascribe them if you please entirely to a simple love of truth, and a desire to excite myself and others to follow such a bright example as we have placed before us in the work which has given me so much pleasure. I have been induced to give the department of comparative anatomy in such minute detail as you see I have done, because there has existed a desire in some individuals here to rob you of your true and well-deserved merit, in supposing that the application of such a system had not been contemplated by you throughout the whole animal Kingdom both recent and extinct. I understand that you were so generous and disinterested as to deposit in the hands of some individual here some prepared sections for the microscope. You would oblige me much if on receipt of this you would have the goodness to let me know, where or in whose hands you did deposit these, and the date. Your doing so at your earliest convenience will very much oblige

Dear Sir

Your very Ob^{t} faithful Servant

ALEXANDER NASMYTH

Retzius answered the letter, but the original has disappeared. However, in the Library of the Caroline Institute in Stockholm the present author found a draft of the letter.[5] This letter has not been published either and is also an important document for our understanding of Retzius' dental investigations. With permission from the Caroline Institute's Library the letter is reproduced here:

Dear Sir,

Allow me to offer you my best thanks for the work on the Development of the Teeth which you had the kindness to send me and for the honorable mention my researches on the same subject have there received at your hands. I was compelled to abandon these and many other interesting microscopical researches in 1836 in consequence of an affection of the eyes from which I still suffer and which has been the main cause that I have delayed so long in answering your flattering letter. The fact is that the state of my eyes only allows me to read a few minutes at a time, and in this manner only have I been able to read your interesting work.

Touching the remarks you have made in the most friendly tone, pp. 161-162, that I had shortly after the publication of my work corrected the statement that no erosion of the milk-teeth took place, allow me to inform you that I made known this fact first to Prof. Flourens of Paris, in a note to a communication on the subject, which I have not yet seen published, and since then to Professor Johannes Müller of Berlin, who has published it in his Archiv where stands on page *cxviii* "Retzius has since found that the process which he discovered took." Thus you find that I corrected the thesis in question shortly after the publication of my work. You have also remarked that I have contradicted myself in my observations on the contents of the dental tuber by saying on the one side that these tubes were filled with lime, on the other, that they were filled with a "nourishing

[5] The catalogue number and designation is: Manuskrift nr. 55:35. A. Retzius. Concepter till bref i åtskilliga ämnen.

and supporting fluid." The charge of contradiction is entirely dependent on a misunderstanding of my remarks: for I have distinctly said, page 82 of my work, "these salts of lime are probably attached to the parietes of the tubes" and in your translation pp. 118-119 stands "These calcareous salts etc." But all is advanced more as a probable than a positive conclusion. God grant that I may soon recover the full use of my eyes, when I shall feel the liveliest satisfaction in continuing and completing these investigations. In the mean time it will give me the greatest pleasure to know that they are in the hands of yourself and other able men, who will treat the subject with all the minuteness and critical severity its importance demands. I have lately seen that Dr. Schwann has touched upon the subject in his excellent "Microscopische——." I have the pleasure to send you a copy of my work, and apologize that the paper and binding are so inferior, but I have no better.

The preparations of teeth, which you ask after, are in the hands of Mr. Clift of the Hunterian, and Mr. Johnson of the St. George's Hospital Museum. Were not my eyes in such a wretched state, I should with much pleasure now send you some newer and finer preparations, which I shall do at all events in case I am happy enough to recover the full use of them.

I have the honour to be Dear Sir

Your obliged and obedient
humble servant

This letter touches several questions which require comment. First, the problem of "erosion of milk-teeth." In his original paper, Retzius stated[6] that in examining deciduous teeth he had found neither tabescence nor resorption nor erosion to occur in these teeth.

Nasmyth's comment on this paragraph is very emphatic: "This is a statement which may be so easily refuted by the simplest observation, that I need not here waste the time of the reader by entering into a formal demonstration of its fallacy."[7] However, Retzius very soon realized the incorrectness of his own statement, and he wrote a note to Professor Flourens in Paris[8] and to Professor Johannes Müller in Berlin correcting his previous account. Müller quoted Retzius' letter in his "Jahresbericht über die Fortschritte der anatomisch-physiologischen Wissenschaften im Jahre 1837":[9]

6 Retzius, *op. cit.* (n. 1), p. 83.

7 In Nasmyth, *op. cit.* (n. 3), pp. 161-162.

8 Marie-Jean-Pierre Flourens (1794-1867), French physiologist. It has not been possible to locate this note.

9 The correction is found in the 1838 volume of *Arch. Anat. Physiol. wiss. Med.*, p. CXVIII. He [Retzius] has later found that the process he described in man and several animals is very exceptional; and that the tooth sack of the succeeding permanent tooth swells at the point of contact to a highly vascular, thick body which apparently secretes a liquor which is able to dissolve chemically those parts of the milk tooth with which it comes into contact. When a milk tooth is removed from a child the part of the sack described is seen at the root.

Er [Retzius] hat später gefunden, dass der Process, den er beim Menschen und mehreren Thieren angegeben hat, zur Ausnahme gehört, und dass vielmehr der Zahnsack des nachschiessenden Ersatzzahnes gerade an der Berührungsfläche zu einem seht gefässreichen dicken Körper ausschwillt, welcher offenbar einen Saft absondert, der die Kraft hat, chemisch die Theile des Milchzahnes aufzulösen, welche mit ihm in Berührung kommen. Wenn man den Milchzahn eines Kindes herausnimmt, so erscheint dieser Theil des Sakkes im Boden.

From another source we also know about Retzius' revised point of view. In a letter to his old teacher, Arvid Henrik Florman,[10] dated 10 Jauuary 1838 he admitted that Florman was right in his criticism of the same paragraph to which Nasmyth objected. As in his note to Müller, Retzius tells Florman that his first description had been founded on exceptions, and that corrosion of the roots of deciduous teeth is the rule.

With regard to the other point of disagreement between Retzius and Nasmyth, viz. the content of the dentinal tubules, it is sometimes exceedingly difficult to understand what the two investigators had in mind. No wonder, because even today the problems have not been settled definitely. The terminology used at that time makes the matter even more confusing. In his book[11] Nasmyth points out that he cannot understand "how a tube can be filled with osseous matter, and at the same time allow the circulation of a 'nourishing and supporting fluid' " as assumed by Retzius. Did Retzius really say and is he right in postulating—in his letter to Nasmyth—that the assumption of a contradiction depends on a misunderstanding on the part of Nasmyth? In his original paper Retzius claimed[12] that the dentin, as seen in cross section, exhibited tubules composed of an outer and an inner zone, and later in the same paper he emphasized that lime salts were attached to the walls of the tubules. Although Retzius did not recognize the presence of the cytoplasmic extensions from the odontoblasts into the dentinal tubules, he suggested that some liquid was responsible for metabolism in the dentin. Apparently, Nasmyth misinterpreted Retzius' statement and thought that Retzius meant the tubules were filled with calcareous matter. Today, convincing evidence has now been obtained by the use of

[10] Arvid Henrik Florman (1761-1840) was Professor of Anatomy at Lund University from 1801. The letter is found on page 111 in C. M. Fürst: *Anders Retzius bref till A. H. Florman,* Lund, C. W. K. Gleerups förlag, 1896. The letter to Retzius in which Florman expressed his criticism is lost.

[11] Nasmyth, *op. cit.* (n. 3), p. 161.

[12] Retzius, *op. cit.* (n. 1), pp. 19-20, 81-82.

optical microscopy, electron microscopy, and microradiography leading to the conclusion that the peritubular space is permeated by a spare organic matrix and is mineralized to a higher degree than that of the surrounding intertubular substance.[13] Thus, with his rather primitive microscope Retzius was able to contribute something new to the structure of the dentin and was not far away from the present-day concept. Retzius and Nasmyth were both true scientists, and their names survive to this day as eponyms for some of the structures they so ably described.

13 D. B. Scott and Marie U. Nylen. Changing concepts in dental histology. *Ann. New York Acad. Sci.*, 1960, *85*, 133-144.

Dental Inlays and Fillings Among the Ancient Mayas*

SAMUEL FASTLICHT**

MAYAN culture covered, geographically, not only the territory which is now the Mexican States of Yucatán, Campeche, Tabasco, and Quintana Roo, but also Guatemala, Belize, Honduras, and San Salvador, a total of about 325,000 square kilometers. In this vast area the Mayas developed an art that was remarkable in all respects; especially admirable were their sculptures in stone and relief work in stucco. It was an art which, according to Covarrubias, combined the priestly character of the Egyptians, the decorative beauty of the Chinese, and the exuberant, deep sensitivity of the art of India.[5] A fine example came to light with the finding of the now world-famous secret chamber of the Temple of the Inscriptions at Palenque, Chiapas (Mexico). Here were found the remains of a priest in a monumental sarcophagus. No discovery to date has been richer than the great jadeite inlayed mask, breastplate, and other ornaments, and the precious stones which revealed the high status priesthood held in Mayan society (Fig. 1).

The formative period of Mayan art began about 300 A.D. and culminated in a classic period, 625 to 800 A.D., with the development and flowering of astronomy, architecture, and hieroglyphic writing. The ninth century was marked by decline and decadence. One of the last political and cultural bastions of the civilization, Chichen-Itza, shows Tula influence in its architecture, and the frequent representations of Quetzacoatl record the influential pressures exerted by cultures of the Mexican plateau. Richness of architectural line and refinement of stucco relief give way to a different kind of decoration which is to be observed in the Temple of the Warriors, the ball court, and the castle, buildings which the Spaniards found in ruins, but which modern archaeological techniques have been able to reconstruct.[29] We do not know the reason for the decline. As Westheim notes, many theories have been

* Read on the occasion of the centennial celebration of the American Dental Association meeting jointly with the American Academy of the History of Dentistry and the Historical Section of the Federation Dentaire Internationale, New York, 1959.

** Mexico City.

suggested, among them soil depletion, epidemics, climatic changes, and earthquakes, but none gives a complete explanation.[31]

Durán Martinéz observes that unquestionably "a rich and varied medical mythology resulted from the endemic and epidemic diseases which constantly beset the Maya."[6]

Morley called the Mayas the "Greeks of America"[17] and Mayan philosophy can in a general way be likened to that of the Greeks, for the Mayan key of life was moderation in everything.[26] Fascinated by the rhythm of time, the Mayas worshipped the divine succession of the days and lived their lives in step with it. They were good mathematicians and made observations of the sun and moon and, according to Thompson, especially Venus. Their calendar was highly developed and its uses may be observed in ornate and complex inscriptions of hieroglyphic steles. To date, interpretation and understanding of Mayan hieroglyphics are rudimentary and uncertain, and a wealth of knowledge awaits deciphering.[28] Caso rightly insists that "the historic data of the steles of the Mayan past urgently need to be deciphered."[3]

In the state of Campeche, Mexico, near the coast, is to be found the famous "island" of Jaina, which at certain times of the year is separated from the mainland and partially covered by sea-water. The island is only two kilometers in length but is important because during the flowering of the Mayan Empire, and probably earlier, it was a necropolis. Moedano has stated that a study of the ceramics of Jaina proves that burial parties came from Yucatán, Tabasco, and even from Chiapas and Oaxaca.[15] He also found superimposed secondary graves, and in several instances an original grave had been opened in the middle to make room for a new and deeper one. This island of Jaina was the main source of information on the custom of tooth mutilation.

TOOTH MUTILATION*

As Romero's study shows, tooth mutilation in different ways was practised not only by the Mayas, but also in men and women in the Valley of Mexico.[21] But it was during the great Mayan Empire that the custom reached its highest development. Three kinds of mutilation are known: filing, inlay, and a third, which is a combination of both. By these methods the natural denture

* Dr. Thomas R. Forbes in a personal communication quoted an interesting remark made by one of the readers of my manuscript. He said: "The word mutilation bothers me a little. I am reasonably certain that the skilled craftsman who did the job thought he was decorating or adorning these teeth rather than mutilating them." I agree completely with this observation.

acquired complicated and beautiful designs of religious significance, which were undoubtedly the pride of their owners. We note that the work was purely ornamental and was never done for restorative dental purposes.

We have already published detailed descriptions of the various designs[7–9,22] originally made by Daniel R. de la Borbolla and modified and enlarged in 1958 by Romero. It includes all types and forms known to date, not only in Central America, but in the entire continent. Of the total 51 forms, 39 have been found in Mexico, and the collection of mutilated teeth in the National Museum of Anthropology of Mexico is the best known, containing 682 specimens from all regions of the country.

The first technique used seems to have been filing. A later technique was inlay. The filing lasted longer and although in decadence at the time of the Conquest, was the only form which the Spanish chroniclers were able to observe. References to the customs are few. However, Fray Diego de Landa, first bishop of Yucatán, wrote in his notes (1566) that "women filed their teeth with stone and water,"[12] and Fray Bernardino de Sahagún, who immediately after the Conquest studied Mexican Indian customs with a true scientific spirit, observed that "they filed their teeth on purpose and painted them black and other colors."[24] (Fig. 2).

The dentist was called, according to Pardal, "Tlancopinalitzli";[19] Molina's vocabulary[16] has the word "Tlantzitziqualia-nite" meaning *to saw someone else's teeth,* that is, to file the teeth into the form of a saw. The inclusion of these words in a Mexican-Spanish dictionary published in 1571, soon after the Conquest, indicated their use.

For technical as well as asthetic reasons, mutilation was done preferably on the six anterior teeth of the maxilla. Among the most recent examples found on Jaina, however, are inlays of upper premolars and lower anterior teeth as well. In one of these lowers there is an abscess, resulting from a lesion probably produced during the preparation of the cavity which was to receive the inlay. Another fine complete specimen has six anterior teeth with five inlays, one lost, four of hematite, and one which appears to have been replaced with a jade inlay during the individual's life. There is an abscess in the upper lateral incisor, with the green inlay (Figs. 3 and 4).

These lesions prove the inlays were made during life, a point we have checked by X-ray studies in earlier reports in 1947.[7]

Generally speaking, however, periapical lesions as a result of bad preparation are exceptional findings. The work was usually carried out with skill and elegance by persons who had considerable knowledge of dental anatomy and almost always respected the vital part of the tooth: the nerves and vessels of the dental chamber. Whether done by dentists, quacks, magicians, or lapidists, inlay art reached a high state of development and was certainly practised for decorative and magical or religious purposes (Fig. 5).

MATERIALS USED FOR INLAY

Since the nineteenth century, turquoise inlays have been mentioned by archaeologists. Hamy described them in 1882,[11] and Frans Blom refers to them again.[1] In 1913 Saville described notable circular and quadrangular inlays of gold from Ecuador.[25] Weinberger[30] called attention to pre-Columbian mutilations and understood sooner than others the cultural significance of what might be called "the dental art" of the ancient inhabitants of this American continent. Sometimes he was too credulous, as in the case of the gold inlayed specimen from La Piedra, Ecuador, referred to and described by Saville. Weinberger accepted what the tropical imagination of the vendor of the teeth had suggested to Saville: namely, that the teeth had probably been re-implanted in the maxilla during life. In my opinion, the Indian who found those teeth had himself planted them in the maxilla to sell them, as Saville said, for three dollars. But in any case Weinberger, as a dental historian and biographer, became interested in this subject before his contemporaries and studied it with enthusiasm.

JADE. In Mexico we have seen and studied only circular inlays of jadeite and hematite, reported in earlier studies.[9] Jade objects have been found in large numbers in tombs, graves, and cenotes (underground wells), pieces were taken from the Sacred Cenote by Edward Thompson, and recently described by Carrillo Gil[2] who gave an interesting example of the quantity and variety of the mineral, but despite these facts, the origin of jade remains a mystery, for no jade or jadeite deposits have been officially reported in America and none have yet been discovered in Mexico. Nevertheless, in ancient Mexico, especially in the region of Mayan culture, jade was widely used. It was not only a precious stone but a symbol of all that was valuable and divine. "Chalchihuitl" the Indian name for jade, was synonymous with beauty.

The source of the jade has been sought by many. The ethnologist Pedro R. Hendrichs, quoted in Romero's excellent book on dental mutilations,[22] says: "jade and jadeite are rock which under certain appropriate conditions can be formed within other rocks, having more or less the same constituent elements. Due to the effects of weather, rocks with jadeite disintegrate slowly, until erosion makes them appear. But because of greater hardness and strength, the jade or jadeite nuclei resist these effects for a longer time and remain as stones in riverbeds and streams, where the ancient lapidists looked for them." Then Hendrichs adds: "Since jade or jadeite deposits have not been found in Mexico to date, it has been thought that the material used by the ancient lapidists to make their jewels, was imported from Asia."[22] Covarrubias, who was interested in the problem and aware of the chronicles of Sahagún and others, says that the technique for finding jade was for the ancient Mexicans, as for the Chinese, a well preserved secret.[4]

The Cement

We were interested in determining whether these inlays, sometimes so well fitted and at other times protruding a bit from the tooth's surface, were cemented or not, for we were surprised that after centuries or perhaps even millenia, they still could be in place. We are aware that the Mayas knew how to use cement in various ways; for example, they cemented pieces of turquoise masks over human skulls. They also did inlaying in various sorts of handles. Museum collections have specimens with inlays of different kinds, for example, eyes. This leads us to believe that the Mayas had sufficient experience to prepare a cement especially for inlays.

Linné, the distinguished Swedish American, although not a dentist, was the first to consider this problem,[13,14] analysing the specimen he found in Teotihuacán, México. The results of our studies, published in 1951,[10] coincide to a large extent with those of Linné. Our analyses were made of the substance adhering to the inlays and the bottom of some cavities in specimens discovered by Alfonso Caso in Monte Alban. The report of the Pacific Chemical Laboratory at Pasadena, California, on spectrographic analysis of the coating of material removed from the inlay, occupying the space between inlay and cavity wall, was as follows:

Calcium	23.5 per cent
Phosphorus	30.4 per cent
Aluminum	0.35 per cent
Silicon	1.51 per cent
Magnesium	1.50 per cent
Iron	2.80 per cent
Manganese	0.055 per cent
Copper	trace
Strontium	trace

The presence of silicon suggests that a calcium phosphate was used as an insoluble cement.

A NEW FILLING MATERIAL

As a result of the most recent archaeological explorations carried out in 1957 by the National Institute of Anthropology of Mexico under the archaeologist Roman Piña Chan and co-workers in Jaina, Campeche, we now have evidence of a new filling material. Many examples of skulls and jaw fragments with tooth mutilations were unearthed. These materials are from the classical period of the old Mayan Empire, for the samples with filled teeth have a special appearance (Fig. 6).

The cavities have a reddish material which at the time of removal from the tomb had a perfectly "normal" and stone-like appearance, but which afterward underwent a surprising change. Still fitting perfectly at the edges of the circular perforation, these fillings began to expand, attaining finally the approximate form of a cauliflower. Apparently, this was a consequence of contact with air and resulting dehydration.

At first we thought this might be an alteration of the hematite (oxidized iron pyrites) so often used for inlays. Since the graves on Jaina were not very deep, the action of sea-water that covers the island at certain seasons could have caused such an alteration. However, other specimens from graves on the same island have complete jadeite and hematite inlays in perfect state.

To clarify the point we turned to specialists and were fortunate in being able to consult Dr. C. Graef Fernandez, Director of the Institute of Science of the University of Mexico, Professor Octavio Cano, research physicist of the University Institute of Physics, and Eduardo Schmitter, geologist of the Department of Mineralogy and Petrology of the Institute of the University of Mexico. Professor Cano made a spectrographic study of a fragment of the

Fig. 1. Skull of a high-ranking personage found in the Temple of Inscriptions in the Palenque Tomb in Chiapas. Notice jade earrings, beads, and fragments of burial mask.

Fig. 2. Fragment of polychrome mural known as "Earthly Paradise" discovered in Tepantitla, Teotihuacán. It probably represents the act of filing the teeth with a stone.

Fig. 3. Mandible from Jaina, Campeche still preserves two inlays in both canines. The four incisors present broken round borders and missing inlays. The X-ray shows an abscess in the right lateral incisor. (Courtesy of the National Museum of Anthropology of Mexico).

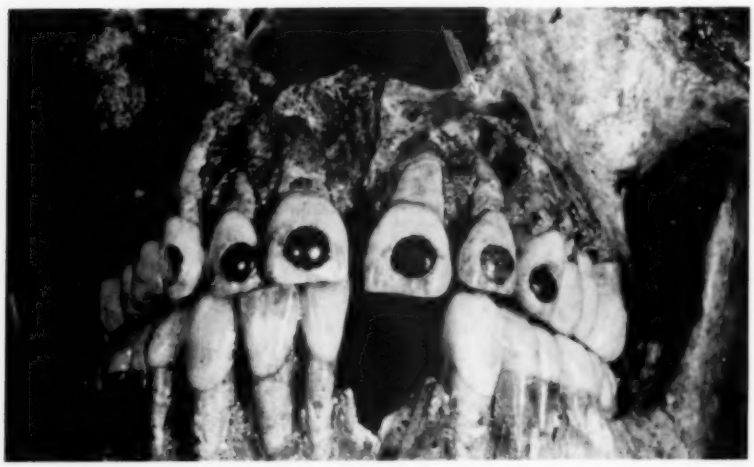

Fig. 4. The four dark inlays are of hematite; one is lost from the right cuspid, and one in the left lateral incisor is replaced with a jadeite inlay. Maya skull now in the National Museum of Anthropology of Mexico. The X-ray shows a periapical infection in the lateral incisor, probably produced by a lesion during the preparation of the cavity for the inlay.

FIG. 5. Jadeite inlays. Maya culture, from the collection of the National Museum of Anthropology, Mexico.

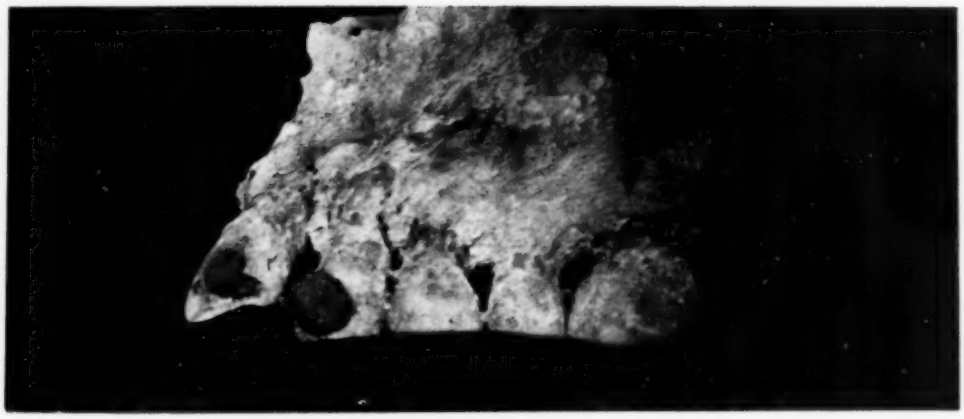

FIG. 6. Teeth with new filling material found recently on the Island of Jaina, Campeche. Now in the collection of the National Museum of Anthropology, Mexico.

material of an inlay and found iron and calcium and recognized a mineral called goethite alfa (Fe_2O_3 H_2O) as the principal component. Another portion of the material was sent to the Department of Mineralogy and Petrology, where in June 1959 the geologist Eduardo Schmitter made a second study.

From both analyses, we reach the following conclusions:

1. Stone, jade, jadeite or hematite, hard mineral stones resistant to the conditions of the mouth and to time, which had always been used before, are, according to Eduardo Schmitter, permanently stable. The material analysed was *not* stable when in contact with air.

2. The material of the inlay is goethite, an iron hydroxide containing a molecule of water.

3. Microscopic and chemical analysis confirmed the presence of a small amount of non-magnetic iron disulphide (FeS_2), or iron pyrites, in *powdered* form.

4. The geologist thinks that the original substance was *powdered* iron pyrites (marcasite), mixed with a substance not identified in the study.

5. During the time elapsed, perhaps 1000 years, it is supposed that the iron pyrites altered from iron sulfide to sulfate, and finally to iron hydroxide.

6. Changes or crystallization and other phenomena made the molecular reduction possible and resulted in the change of volume.

Comment

We have no solid data to explain the cause of such a radical change in the type of material used to fill a cavity. However, even today dentists know it is hard to get a good fit for an inlay. Filling the cavity with a paste is easier and gives almost the same esthetic effect.

We may suppose, for the time being at least, that the original inlays might have been lost, because of bad fitting or by some accident, and the dentist or ingenious lapidist found it easier to replace the inlay with a material similar to the original (reddish brown pyrite or hematite).

Our main unanswered question is, what vehicle was used so that the paste of iron powder and liquid could resist so many centuries? We realize that cemeteries like that of Jaina still hold many secrets, which will reveal facts, now unknown, about the

custom of tooth mutilations, a subject of continual interest and fascination.

SUMMARY

A brief background of the culture of the Mayas, called by Morley the Greeks of America, is presented. Different types of tooth mutilation are mentioned and the materials such as jadeite and hematite used for tooth inlays are described and illustrated. A different filling material, a paste made of powdered iron pyrite, mixed with an unknown vehicle, which was probably used in substitution for solid inlays, is reported.

ACKNOWLEDGMENT

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L'EMAILLATTEMENT (BINDING OF NEWBORN CHILD)

An engraving by Tavernier after Abraham Bosse (1602-1676). New Haven, Yale Medical Library, Clement C. Fry Collection.

Abraham Bosse's etching of about 1635 is one of a series illustrating the common therapeutic measures in the medical armamentarium of the mid-seventeenth century, of which binding or swaddling of the newborn infant was one of the most abominable.

Before the coming of the humanitarian eighteenth century, no human being was more abused than the infant. Parents viewed the death of 75 per cent of their children before the age of two as a normal condition and entirely in accord with nature's plan. A dismal example of improper child care was set by Queen Anne, who ruled England from 1702 to 1714. Not one of her 18 children survived to maturity. Child care was in a deplorable state before 1740 and physicians left nurses and mothers without advice or guidance.

Not until the mid-century did there appear physicians determined to liberate babies from their life-strangling bundles and to offer sound advice to mothers. Most eloquent of these educators was Dr. William Cadogan of London. In his *Essay upon nursing* (1748) he thundered against the dangers of swaddling babies tightly, and interest in proper care of children was thereby greatly increased.

The *dramatis personae* of the engraving include the mother, who is swaddling the infant; a wet-nurse, who holds the binding cloth; a maid, who warms the infant's bedding in front of the fire; another maid, in the background, who puts the bed in order. Each recites, as it were, a quatrain, engraved below the picture. The mother speaks of her confinement. The wet-nurse asks for appropriate remuneration if her breast-milk is to be utilized. The two maids claim that they can do their work with proper enthusiasm if they are appropriately and generously rewarded.

It can be seen that the infant being wrapped in the engraving looks like a mummy. Many an infant ended up as one! The swaddling consisted of a heavy, airtight wrapping of bandages which was meant to keep the bad air out and the "nourishing juices" in, and to keep the little ones from thrashing annoyingly about. It was, in addition, considered dangerous to change diapers too often. It is obvious that these babies were not apt to remain healthy for any extended period of time.

Abraham Bosse, who portrays this marvelously detailed example of comfortable French life during the Regency and early part of the reign of Louis XIV, was typically the artist of the upper middle class, and he depicted their medical customs and practices with fidelity and vividness.

D. S. D.

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La mine de cette accouchee
me semble fi fort en bon point
que volontiers pour mon argent
je voudrois faire emplette.

A cette gentille Nourrice
comme de fon humeur
aimeé on pourroit prendre fon fait
pour bien luy rendre feruice.

Et pour cette jeune feruente
qui chauffe le coucher a l'enfant
on luy pourroit en heure bonne
le croy quelle feroit contente.

Voicy a faire le meſnage
et leur tenir a dreſſer fon lict
mais pour y prendre fon deduict
je fais mieux encor ſon meſtrage.

Bonnart fc.

Bonnart excudit.

Notes and Events

Edited by Dorothy M. Schullian*

Sir John Berkenhead's Lines on William Harvey, 1651

In the October 1956 issue of this Journal (vol. 11, no. 4) F. N. L. Poynter (pp. 374-383) and Conrad Hilberry (pp. 384-411) simultaneously drew attention to the poems of John Collop, M.D., published under the title *Poesis rediviva* in 1656 (London, Humphrey Moseley). Poynter was particularly concerned with Collop's verses on William Harvey and the blood, which seemed to "represent the earliest reference to Harvey's work in English literature," since they antedated then known allusions by a number of years. He pointed out that Dryden's lines "which have hitherto held this place of honour were still unwritten and were not published until seven years later," that is 1663, the year also of Cowley's *Ode upon Dr. Harvey*.

Here we draw attention to a still earlier mention of Harvey and his discovery, from the year 1651, not only because every detail of *Harveiana* is by reflection from the great man important in itself but also because it adds yet another famous contemporary to the list of his admirers. We will not stay to consider priority claims on behalf of Martin Llewelyn's dedicatory poem to Harvey's *Anatomical Exercitations, Concerning the Generation of Living Creatures*, 1653 (London, James Young, for Octavian Pulleyn) because it came two years after the poem to be considered here, nor of Henry More's *Circulatio sanguinis*, "written while he [Harvey] was still alive, and probably shortly after the publication of *The Generation of Animals* (1651), which More knew well," because it was apparently not published until 1679, in *Scriptorum philosophicorum tomus alter* (*Philosophical Poems of Henry More*, edited by Geoffrey Bullough, Manchester University Press, 1931, pp. 169-172, 243).

The author of the poem here referred to was Sir John Berkenhead (1616-1679), whose career is detailed in *DNB* (which incidentally gives the first spelling of his name as "Birkenhead"). It is entitled *In Memory of Mr. William Cartwright* and takes up three and a half leaves commencing on leaf *8r of the preliminary unnumbered leaves of dedicatory verse prefixed to *Comedies, Tragi-comedies, with Other Poems, by Mr. William Cartwright, late student of Christ-Church in Oxford, and proctor of the University*, 1651 (London, for Humphrey Moseley). The lines concerning Harvey occur in the middle of the third page of the poem (see Fig.):

* History of Science Collections, Cornell University Libraries, Ithaca, New York.

For as immortall HARVEY'S *searching Brain*
Found the Red Spirit's *Circle in each Veyn,*
Hath open'd Straights, *and saild our World about,*
As if He made *that Sluice, not found it out:*
So Wit, *the bloud of Verse, in every line*
Drawn by thy hand, doth shoot, and work, and mine,
This Gulfe, that Isthmus, *through each* Science *dart's,*
And proves its Circulation *through all* Arts.
All-over Wit, ne'r runs a-ground, but rides
In ever-flowing never-ebbing Tides.

Where are ſuch Flames, ſuch Puiſſance and Sway,
As thy CRATANDER, *or* LUCASIA!
His Soul would fill a Globe; yet big as 'tis,
Hers would inform me *as great a World as His.*
What vaſt ſweet Horrours (Love and Wit) expreſt!
Such Living Metaphors, ſo coſtly dreſt,
Thy Language is all Tiſſue; no one part
But comes from All the Magazines of Art.
For as immortall HARVEY'S *ſearching Brain*
Found the Red Spirit's *Circle in each Veyn,*
Hath open'd Straights, *and ſaild our World about,*
As if He made *that Sluice, not found it out:*
So Wit, *the bloud of Verſe, in every line*
Drawn by thy hand, doth ſhoot, and work, and mine,
This Gulfe, that Iſthmus, *through each* Science *dart's,*
And proves its Circulation *through all* Arts.
All-over Wit, ne'r runs a-ground, but rides
In ever-flowing never-ebbing Tides.
Not ſometimes rampant, ſometimes groveling down,
But ſtill keeps up its brave Complexion;
Which, like a German *Prince's Title, runs*
Both to thy eldeſt *and to* all *thy Sons.*
For Thine's a Spring; *Thy Phanſie works and beats*
Swift as the Pulſe, *and ſtrikes no ſecond Heats.*

The poet likens Harvey's description of the circulation of the blood—so grand in its conception *"As if He* made *that Sluice, not found it out"*—to Cartwright's "Wit, *the bloud of Verse, in every line"* revealing *"its* Circulation *through all* Arts." Particularly noteworthy is Berkenhead's point that wit *". . . rides, In ever-flowing never-ebbing Tides,"* which would seem to indicate his realization that the discovery of the circula-

tion presupposes the existence of one-way traffic in the blood vessels. This, as F. J. Cole (*Notes and Records of the Royal Society*, 1955, *11*, 222-227) pointed out, was the essence of Harvey's discovery which distinguished it from his predecessors' ideas about the circulation; the like discovery in respect of the nervous system laid the foundation of modern neurology when in 1811 Charles Bell distinguished motor and sensory function in the anterior and posterior nerve roots. In this respect Berkenhead's lines may show a sounder grasp of Harvey's fundamental physiological advance than Collop's, who five years later compared the sun to the blood in terms of ebb and flow (*cf.* "Flows into flesh, and then ebbs back again" in *Of the Blood* quoted by Poynter, *loc. cit.*).

This is not the place to discuss how the scientific concept of the circulation inspired the poetic imagination of the time, but it is worth pointing out that Berkenhead was still up at Oxford in 1642 when the Court and Harvey with it came there during the Civil War. In fact, he became a leading figure and founder and editor of the Royalist newssheet "Mercurius Aulicus." Harvey moved in the same circles not only as Royal physician but also as Fellow and Warden of Merton College, where the Queen herself lodged, until the surrender of the city in 1646 when he returned to London and Berkenhead went into exile with the future Charles II. It can therefore be assumed that Berkenhead had ample opportunity to become acquainted with Harvey and his achievements, if not directly from Harvey himself, then at least from the students assembled around him. And some of the fifty other contributors of verse to Cartwright's volume who included James Howell, John Finch, Thomas Baines, Martin Llewelyn (here "M.LLuellin"), and Ralph Bathurst (and incidentally also Izaak Walton), all of whom have established links with Harvey, may well repay more careful study in this connection by some future definitive biographer.

RICHARD A. HUNTER
IDA MACALPINE

Medicinhistorisk Årsbok, 1961

The yearbook, *Medicinhistorisk Årsbok*, which is issued by the Medical-Historical Museum in Stockholm under the editorship of Wolfram Kock (cf. Journal, 1961, *16*, 313-314), enjoyed in 1961 the co-operation not only of The Danish Society for Medical History and its representative Egill Snorrason but also of The Norwegian Society for Medical History (Bernhard Getz, representative) and the Amici Historiae Medicinae of Helsingfors (Kivi Lydecken, representative).

As usual the articles, most of them reprinted from various journals, are summarized in English. It is helpful to have the special reports on activities in medical history during 1961 in Sweden, Denmark, Norway, and Finland. Dr. Kock provides an account of visits over a period of years

to medico-historical museums in Europe and the United States. Swedish contributions include also his and Bengt Melin's translation of Christian Ernst Boecler's dissertation (1772) on wound sutures and studies by Karl Otto Granström and Alf Åberg on Charles XI's word blindness, Hugo Theorell on medicine and chemistry, Göran Liljestrand on the Caroline Institute and also on Robert Tigerstedt (1853-1923), Willy Hallgren on the Swedish Veterinary Society, Arvid Wallgren on the pediatrician and statistician Fredrik Theodor Berg, Ingvar Alm on the fiftieth anniversary of the founding of Sach's Child Hospital, Gösta Häggqvist on the Caroline Institute, and Erik Sköld on St. Erik's Hospital. Vilhelm Møller-Christensen discusses a skeleton found in excavations at Seeland, Denmark, Vilhelm A. Fenger, Danish court-physicians, Jens Strøyberg, the papers of his chemist great-grandfather, and Aage Kristjansen, photographs of Danish prostitutes. Louis Perret contributes an account of medicine in Finland during the eighteenth century.

In addition, beyond the range of Scandinavian history, Otto C. Aagaard writes on Chinese ivory dolls, Eric Jonsson on the Auenbrugger anniversary of 1961, Kurt Baerentsen on weights and measures in early pharmacopoeias, Tomas Gejrot on morbus Ménière, and Hans Gabriel Dedichen on the decline of chlorosis as fashion ceased to demand tight lacing.

The Fulton Society

At the meetings of the International Congress of Neurology in Rome in September 1961 Dr. A. Earl Walker of Baltimore, Dr. Giuseppe Moruzzi of Pisa, and Dr. Victor Soriano of Montevideo paid tribute to the memory of John F. Fulton.

At the same meetings friends of Dr. Fulton organized The Fulton Society in his memory. It will arrange every second year a symposium on some phase of modern neurology with which he was particularly concerned. The first symposium will be held in 1963 in connection with the meetings of the American Neurological Association; the subject will be "Motor and Premotor Areas." Further information can be obtained from Dr. Victor Soriano, Calle Buenos Aires 363, Montevideo, Uruguay.

History of Medicine Seminars at The Mount Sinai Hospital, New York

The History of Medicine Seminars of The Mount Sinai Hospital of New York have been resumed under the chairmanship of Dr. Saul Jarcho. During the past year the following meetings were held: 5 February: Modern Pathology, the Evolution of its Meaning, Paul Klemperer; 2 April: The Purposes and Methods of Historical Writing, Saul Jarcho; 4 June: Some Notes on the History of Salt in Medicine, S. Zelig Sorkin.

Historical Gleanings

For a thorough study of "Greek Philosophy and the Discovery of the Nerves" readers are referred to the article by Friedrich Solmsen in *Museum Helveticum,* 1961, *18,* 150-167 and 169-197, the first section of which is concerned with pre-Socratic and related doctrines, the second with Plato, the third with Aristotle, the fourth with post-Aristotelian doctrines, and the fifth with the discoveries of Herophilus and Erasistratus.

The medical virtues of hyssop are included by Alfred C. Andrews in his discussion "Hyssop in the Classical Era" in *Classical Philology,* 1961, *56,* 230-248.

In *Bucknell Review,* 1960, *9,* 247-255 Vern L. Bullough discusses "Medieval Medicine and the Search for Status."

The results of Loren C. MacKinney's most recent investigations of miniatures in manuscripts are published in the article "Medieval Medical Miniatures in Central and Eastern European Collections" in *Manuscripta,* 1961, *5,* 131-150.

The first genuine evidence of degrees in medicine at Oxford comes only in the fourteenth century, and Oxford seems to have had little influence on the practice of medicine in England during the Middle Ages. Vern L. Bullough discusses the problem in his article "Medical Study at Mediaeval Oxford" in *Speculum,* 1961, *36,* 600-612.

Curt F. Bühler of The Pierpont Morgan Library is the possessor of a Middle English medical manuscript of 61 leaves written by various hands in East Anglia in the fifteenth century. He describes it in *Studies in Medieval Literature in Honor of Professor Albert Croll Baugh,* edited by MacEdward Leach (Philadelphia, University of Pennsylvania Press, [1961]), pages 285-298. Its two chief items are a herbal and a medical treatise, both in verse.

In *Libri,* 1961, *11,* 355-363 Ruben Eriksson discusses the provenance of MS. Holm.X.93 in the Royal Library at Stockholm. This manuscript contains the eye-witness report of Baldasar Heseler on Vesalius's first public anatomy at Bologna, 1540, which was published by Dr. Eriksson in 1959. In the article Dr. Eriksson describes also manuscripts of Avicenna, Bernard de Gordon, Gilles de Corbeil, and John Arderne in the Royal Library.

Interest in Ambroise Paré has increased steadily ever since the publication, in 1937, of Janet Doe's bibliography of his works. In 1940 Miss Doe issued a list of addenda to the bibliography. A supply of this list remains; she will be glad to send a copy to anyone requesting it. Miss Doe's address is 10 Druid Place, R.F.D. 1, Katonah, New York.

In *Studies in Philology,* 1960, *57,* 622-633 Francelia Butler identifies as John Penkethman the author of two plague tracts published in London

under the pseudonym J. Patridophilus. The first, *The Cities Comfort* (STC 16750), is a prose broadside issued by G[eorge] P[urslowe] presumably during the period July-November 1625. The second, *A Preservative Poem,* is a small octavo printed by Anne Griffin for William Leake in 1636; it elaborates the theme of the broadside, and the Boston Medical Library owns what is said to be the unique copy of it.

Medical or art historians using William S. Heckscher, *Rembrandt's Anatomy of Dr. Nicolaas Tulp* (New York, 1958) will want to take into account the additional suggestions advanced in C. E. Kellett's perceptive review in *The Burlington Magazine,* 1959, *101,* 150-152.

Patrick Romanell's study of Locke is continued in his article "Locke's Aphorisms on Education and Health" in the *Journal of the History of Ideas,* 1961, *22,* 549-554.

In a letter to the editor of the *Times Literary Supplement* which appeared in the issue of 12 January 1962 Richard Hunter gives his views on the identification of the establishments to which Kit Smart was twice confined.

For the fiftieth anniversary of its founding CIBA Industria Chimica of Milano issued in 1961, under the editorship of Luigi Belloni, a sumptuously illustrated volume containing Pietro Moscati's academic discourse (Milano, 1784) *Dei vantaggi della educazione filosofica nello studio della chimica* and Marsilio Landriani's *Relazione sopra Basilea, Aarau, e Bienne,* which recounts a trip of 1787 and is here published from a manuscript in Milano. Each tract is provided with ample introduction and commentary. Dr. Arthur Wilhelm, president of CIBA, furnishes a preface.

Conditions in Britain's naval medical service from 1793 to 1815 are examined by Eunice H. Turner in *The Mariner's Mirror,* 1960, *46,* 119-133. The article is based primarily on letters which passed between the Lords of the Admiralty and the Commissioners for the Sick and Hurt, the Transport Board and the Hospital Governors.

The *Catalogue of the Library of the Medical Department of the University of Louisville* (Louisville, 1847) included a regulation that "at the close of each session of the Medical Department, the President of the Board shall appoint a committee, whose duty it shall be to examine the Library on the first Monday in April, or as soon after as practicable, and make report of the condition of the Library." It was fitting therefore that on Monday, 2 April 1962, for the 125th anniversary of this library which was founded in 1837, its friends were invited to examine it. Its condition is good; the immediate past librarian Blake Beem and the present librarian Joan Titley have discharged the duties of their office faithfully and satisfactorily in the best tradition of their predecessors.

The Irish Censorship of Publications Act, 1946, is denounced by L. R. C. Agnew in his article "Celtic Twilight" in *Kansas Business Review,* 1962, *15*.

Chauncey D. Leake's address as retiring president of the American Association for the Advancement of Science, delivered in Denver on 28 December 1961, was published the following day in *Science, 134,* 2069-2079. Entitled "The Scientific Status of Pharmacology," it provides a helpful review of the development of pharmacology as a science and is insistently historical in its emphasis.

Of interest for the early history of studies on the physiology of aging is Vladimir Nikolaevich Nikitin's *Russian Studies on Age-Associated Physiology, Biochemistry and Morphology* as translated by Paul dePorte from the fuller publication, in Russian, of 1958 and published by the National Institutes of Health, Bethesda, Maryland, in 1960.

The covers of the tenth anniversary number (November, 1961) of *News to the Friends of the Library of the History of Medicine,* issued from the University of Kansas Medical Center, carry in reproduction a variety of fascinating stamps and inscriptions of ownership selected from the library's books. These devices are often in themselves documents of medical history.

It is fitting to make special mention here of the satirical essay by the late Frederick C. Irving entitled "Aesculapius Inspects the Harvard Medical School" (*New York Medicine,* 1961, *17,* 938-945). It was reprinted in this issue of 20 December "to add merriment to the coming holiday season."

The Deutsche Gesellschaft für Geschichte der Medizin, Naturwissenschaft und Technik will hold its 45th annual meeting 10-14 October 1962 in Bad Driburg (Westphalia).

S. N. Gaño (Journal, 1961, *16,* 314) reappears in *The Leech,* Autumn, 1961 with an article entitled "Books and their Enemies." It was written during frenzy induced when his part-time maid Aida undertook to dust his 3,000 books. The result was dire to both their phyiscal condition and their arrangement on the shelves. Lind on scurvy, for example, had parted with its title page and cover, the seven volumes of *The Papers of Thomas Jefferson* were shelved in the order 4, 2, 3, 1, 7 (upside down), 5, 6, and the two volumes of the Loeb Suetonius were separated by Pinocchio.

Book Reviews

HENRY GUERLAC. *Lavoisier, the Crucial Year. The Background and Origin of His First Experiments on Combustion in 1772.* Ithaca, Cornell University Press, 1961. xix, 240 pp., 11 illus. $4.50.

Reviewed by VICTOR A. EYLES, *The Old Cottage, Great Rissington, Cheltenham, England.*

THERE have been many books about the chemist Lavoisier and his work. Professor Guerlac's object in adding to their number is to present the results of his searching enquiry into the circumstances which in 1772, the 'Crucial Year,' prompted Lavoisier to carry out between September and November his first historic experiments on combustion. His subsidiary intentions are to re-create the state of chemical knowledge and opinion in the France of 1771-1772, and to make readily available all the important documents known to him that bear on this phase of Lavoisier's career.

Until the summer of 1772 Lavoisier's chemical activities had not been canalized into any particular course; and there is little or no positive evidence to suggest that he had any previous interest in calcination and combustion and the part played by air in these phenomena. The question as to what aroused his interest is not a new one, of course, and has been considered by other writers, notably A. N. Meldrum and Max Speter. Professor Guerlac discusses the views of these authors in the light of new information which has become available since they wrote.

In gathering material for his book, a task on which he has been engaged for a number of years, Professor Guerlac has played the role of a detective searching for evidence. In the book itself he plays a second role, that of an advocate addressing a jury. Space does not permit a detailed examination of the author's somewhat discursive presentation of his case—he admits himself the argument is an intricate one—but we can give some consideration to his conclusions. In reaching them he has made much use of the two earliest documents known in which Lavoisier mentions the possible chemical role of air. These are the 'August Memorandum,' dated (probably not in Lavoisier's hand) 8 August 1772, and the recently discovered document entitled *Système sur les Elémens*, also dated August, 1772. These, and other relevant MSS, are printed in full in appendices.

In Chapter VI Professor Guerlac reaches a new conclusion on an old problem, the relationship between Lavoisier and the pharmacist Mitouard, from whom he bought the phosphorus used for his first experiment. He argues, quite convincingly, (i) that Mitouard's own experiments with phosphorus were carried out at a somewhat earlier date than those of Lavoisier; (ii) that Lavoisier had an early knowledge of the results; and (iii) that this knowledge may have been the immediate incentive that

decided Lavoisier to use phosphorus for his own first experiment. These conclusions still leave open the main question as to why Lavoisier began to study the role of air in chemical phenomena at all; it is with this question that the author is largely concerned.

Professor Guerlac first of all emphasizes the influence on chemical thought in France exerted by Stephen Hales' work on air through his book *Vegetable Staticks,* published in a French translation in 1735. He then argues that it is unlikely that the work of Black and of Cavendish can have had any direct influence on Lavoisier before 1772. This can only be inferred and, at least in the case of Black, it cannot be said the inference is conclusive.

The author also discusses the work of Guyton de Morveau. As pointed out by Partington and McKie in 1937, de Morveau established by a series of carefully controlled experiments that metals increase in weight on calcination.[1] Previously this fact had been doubted and disputed by many chemists. The experiments were described to the Académie des Sciences, in Lavoisier's presence, on 8 February 1772 and published later that year in de Morveau's book *Digressions académiques.* Professor Guerlac shows that Lavoisier was conscious of his debt to de Morveau, though he never acknowledged it in print; and it seems a fair conclusion that the results of these experiments must have had a considerable and perhaps the most important influence on Lavoisier's chemical ideas.

The author also argues at some length that Lavoisier had been especially impressed by the phenomena of effervescence that accompanies the action of acids and also the reduction of a 'calx' to metal. In this connection he discusses the extent to which Lavoisier may have been influenced by the work of Priestley. He mentions the reception in Paris, early in 1772, of letters from London giving an account of Priestley's *Observations on Different Kinds of Air,* read to the Royal Society in March that year; and that Macquer read a summary of the contents of these letters to the Académie, in Lavoisier's presence, on 1 April. He also recalls Professor D. McKie's discovery that the April issue of Rozier's Journal included a statement about Priestley's work, which, Professor Guerlac infers, was probably based on these letters.[2] Professor Guerlac cursorily dismisses the possibility that these accounts could have influenced Lavoisier or even interested him. On the other hand, he believes that it was Priestley's pamphlet *Directions for Impregnating Water with Fixed Air,* which was received in Paris in July, 1772, that first aroused French interest in his work. Certainly the pamphlet attracted some attention. It was accompanied by a covering letter addressed to Trudaine de Montigny, which was read to the Académie by Lavoisier on July 18th. But this pamphlet

[1] J. R. Partington and Douglas McKie, "Historical studies on the phlogiston theory—I. The levity of phlogiston." *Ann. Sci.,* 1937, *2,* 361-404.

[2] Douglas McKie, "The *'observations'* of the Abbé François Rozier (1734-93)—I." *Ann. Sci.,* 1957, *13,* 73-89.

was primarily of medical interest; and the French translation that became available in mid-August seems to have been made principally *"pour faire distribuer gratis, principalement aux medicins."* So far as Lavoisier is concerned, it is difficult to believe that he attached more importance to this pamphlet than to the earlier announcement that Priestley was experimenting on air in England. To the reviewer, at all events, it seems that Professor Guerlac has over-emphasized the influence which he believes this pamphlet exerted. He mentions three French chemists who, late in 1772 or early in 1773, undertook experiments dealing directly with the production and properties of fixed air and whose work, he claims, "reflects the stimulus of Priestley's pamphlet." Let us consider the case of one of them, J. B. M. Bucquet, who, it can be shown, was interested in fixed air well before the arrival of Priestley's pamphlet in France. Bucquet, though a medical practitioner, was undoubtedly deeply interested in chemistry. He had given lectures on the subject before 1771 and, towards the end of that year, published a textbook of mineral chemistry, *Introduction à l'étude des corps naturels tirés du règne minéral* (2 vols., Paris, 1771, duodecimo). In this book (vol. I, pp. 214-216), under the subheading *'Analyses des pierres calcaires,'* he describes the experiment by which limestone is reconstituted and precipitated on passing 'fixed air' through lime water, a knowledge of which he had gained from the French translation (Paris, 1766) of D. MacBride's *Experimental Essays on Medical and Philosophical Subjects* (London, 1764). As to Bucquet's later experiments, Professor Guerlac has stated in an earlier publication,[3] apparently with reference to the report on these experiments made to the Académie by Lavoisier and Desmarest in 1773, that "there is not the slightest hint that Bucquet's interest in 'fixed air' had any connection with mining, metallurgy, or mineralogy." This is a strange conclusion to reach about a man whose book indicates clearly that he was profoundly interested in all three subjects. It can also be stated that the Report on his experiments contains no hint that they were stimulated by Priestley's pamphlet.

It may be suggested that Professor Guerlac might have given some consideration to the possibility that influences of a more general character may have played a part in directing Lavoisier's thoughts towards the classic experiments he carried out in 1772. It is accepted that before that year he was more occupied with geological matters than with chemistry; but the fact that he carried out chemical experiments in furtherance of his geological enquiries suggests that his interest in chemistry was already strong. This inference receives support from a purchase of books he made in Strasbourg in 1767. Among the 115 or so titles listed, a rough classification indicates at least 33 on chemistry, but only 11 on geology. A man of Lavoisier's ability and ambition is likely to have read every book he could

[3] Henry Guerlac, "Some French antecedents of the chemical revolution." *Chymia*, 1959, 5, 73-112, Ref. p. 111.

obtain on subjects of interest to him. Obviously, even at this early stage in his career, chemistry was one of them. And then, as Professor Guerlac points out, knowledge of the advances in pneumatic chemistry made in Britain had been reaching Paris for some time. Lavoisier himself wrote, admittedly twenty years later, but not necessarily falsely: *"Il y avoit à cette époque une correspondence habituelle entre les savans de France et d'Angleterre."* (*Oeuvres,* vol. I, p. 102). Professor Guerlac discusses letters received in Paris from Magellan in London, but were there no other correspondents?

There was, too, an exchange of visitors interested in chemistry between London and Paris. We know that Benjamin Franklin, friend and correspondent of Priestley, visited Paris in company with Sir John Pringle in 1767 and again in 1769. He met members of the Académie on the latter occasion, possibly Lavoisier himself. Another visitor in the winter of 1768-1769 was Benjamin Rush, only a few months after a two-year stay in Edinburgh, where he had attended the lectures of Joseph Black. He records being hospitably received by the French chemists, mentioning specifically La Roux, Baumé, and Macquer. In the opposite direction there was the visit of the Duc de la Rochefoucauld d'Enville, patron of the sciences, to London in 1769, where he dined at the Royal Society Club on 2 March. Visits such as these would surely have led to informal discussions in Paris about the advances in pneumatic chemistry already made in Britain. Lavoisier, in the original version of his 'Sealed Note' of 1 November 1772, stated as his reason for depositing it: *"Il est difficile de ne pas laisser entrevoir Ses amis dans la Conversation quelquechose qui puisse les mettre Sur la voye de la verité."* Are we to suppose that during the conversations to which Lavoisier alludes it was all 'give' and no 'take' on his part?

Whatever the weight to be attached to the various isolated factors that may be supposed to have influenced Lavoisier, a wide general knowledge of the chemistry of the period gleaned from all sources open to him may surely be presumed. This should be coupled with the fact that the times were ripe for just those advances actually made by Lavoisier. As Professor Guerlac points out, the advances followed from a merging of the mineral chemistry of the continent with the pneumatic chemistry of Britain; and it does not seem absolutely necessary to conclude that certain specific factors had a major influence on the development of Lavoisier's thought.

In spite of his exhaustive search, Professor Guerlac has not succeeded in finding any positive evidence that before the summer of 1772 Lavoisier displayed any interest in the problem of combustion, or the calcination of metals, but that does not prove that such an interest was non-existent. In fact, it seems to the reviewer to be going rather far to conclude, as the author does, that before the summer of 1772 Lavoisier had not "given any thought to the possible participation of air in chemical reactions."

Professor Guerlac also concludes, from the words in Lavoisier's 'Sealed Note' of 1 November 1772 (quoted above), that Lavoisier was led to deposit this and other sealed documents with the Académie through fear that he might be anticipated by French, rather than British chemists. One is tempted to suggest that Bucquet could have been one of his rivals. Bucquet's experiments were conducted in the laboratory of the Duc de la Rochefoucauld, and the latter, so Professor Guerlac informs us, was a friend of Turgot, whose remarkable anticipation, in 1771, of Lavoisier's conclusions is discussed by the author. Bucquet makes an interesting statement in his book (vol. I, pp. 61-62). He writes: *"L'air entre dans la composition de presque tous les corps de la nature . . . il entre dans la combinaison de presque tous les minéraux; cependant il n'est pas prouvé que les métaux en contiennent."* Lavoisier, in his 'August Memorandum,' is less positive. He wrote there: *"Il paroit Constant que l'air entre dans la Composition de la plus part des Mineraux, des Metaux meme Et en tres grande abondance aucun chimiste Cependant n'a fait encore entrer l'air dans la definition ni des Metaux ni d'aucun corps mineral."*

To refer again to Professor Guerlac's reasons for writing this book, his principal object has been an attempt to solve the problem as to what stimulated Lavoisier to commence his classic experiments in 1772. Fact, inference, and advocacy are so intimately interwoven in the text that it needs very careful reading, but one is left with the impression that in putting the case for some of his conclusions the author has indulged in special pleading, which, no doubt, is the privilege of the advocate, but not, I think, of the historian? Whether the conclusions can be accepted in their entirety must be left to the jury—his readers.

As to the author's second objective, an exposition of the state of chemistry in France in the crucial year, the book is informative, and readers are given the benefit of Professor Guerlac's wide knowledge of the subject. Much that the book contains, the numerous references to source materials, and especially the Appendices in which relevant MS material is printed, is not readily available to the average student, and the author has performed a valuable service in making this information easily accessible.

As a minor criticism one may mention the use the author makes of footnotes. These, though extensive, are not indexed, and some of the information they contain might, with advantage, have been included in the text. Conversely, the reader's attention would not be so frequently diverted from the argument if some of the discursive matter in the text, interesting though it is, were relegated to footnotes. It is annoying, also, to have to look back, over 50 pages in some instances, to find a *'loc. cit.'*

While provocative of some criticism, Profesor Guerlac's book contains much of value for students of eighteenth century chemistry, by whom, no doubt, it will be read with interest and profit, even if they are not specially concerned with the Lavoisier saga.

ESMOND R. LONG. *Selected Readings in Pathology.* 2d ed. Springfield, Illinois, Charles C Thomas, 1961. ix, 306 pp., 25 illus. $8.50.

Reviewed by LESTER S. KING, *Clinical Professor of Pathology, University of Illinois College of Medicine, Chicago, Illinois.*

WHEN Sigerist in 1934 published a "Tentative Syllabus" for a course in medical history, the source material readily available to students was rather scanty. Prominent in his list of suggested readings was Long's *Selected Readings in Pathology,* which had been published in 1929. This volume presented substantial extracts from the writings of famous physicians who had contributed greatly to pathology, starting with Hippocrates and ending with Virchow. Since the 1930's there has been a steadily increasing interest in medical history, and correspondingly there have appeared reprints of numerous medical classics, usually in abbreviated or extracted form. Yet the popularity and significance of *Selected Readings in Pathology* remained very high. The edition has long since been sold out and, what is even more significant, the owners hold on to their copies. Very rarely does the title appear in a book-dealer's catalogue, or a copy find its way into the second-hand book stores.

Now after a lapse of 32 years a second and revised edition is presented. There have been many changes which suggest, perhaps, a new attitude of the publisher, a stream-lining, so to speak, and a concession to certain present-day trends. All this arouses mixed feelings, since any new mode of presentation is not necessarily an improvement over the old. In this new edition, the old authors are still represented, but in addition there appear extracts from thirty new pathologists, representative of the many who have achieved prominence since the latter nineteenth century. Yet the over-all length of the book remains approximately the same, just over 300 pages, and the general format is similar. Obviously, something had to give way. The additions were achieved by cutting down the length of the earlier selections, and by making each of the new extracts quite brief. In this second edition the section covering Hippocrates to Virchow which comprised the entire original volume, now occupies less than three-fifths of the original length.

The question then arises, how valuable are the reduced quotations? and this in turn raises the problem, what is their purpose? It is obvious that a relatively short extract is not a substitute for a large text, nor does it in any way serve scholarly investigation. But skilfully chosen extracts can have great teaching value. They can illustrate the problems that faced the earlier investigators, suggest the contemporary attitudes, techniques and methods, can reveal the way in which the leading physicians approached their particular problems, and the tentative solutions offered. Adequate selections furnish a commentary on the permanent values in

science, namely, the careful observation and the judicious inference. All this can be accomplished if, besides the bare narration, the selections can exude a sufficient flavor, can display sufficient detail to make a meaningful background. In our opinion the revised and abbreviated selections are less successful in achieving this purpose than were the original selections. The flavor has in many cases been considerably blunted, the impact reduced. "Unnecessary" detail has been omitted, but at the expense of vividness.

The new additions encompassing extracts from 30 writers range from Cohnheim and Paget, through Metchnikoff, Fallot, Smith, Mallory and Ricketts, to Aschoff, Hektoen, Yamagiwa, and Whipple, to name but a few. Among those modern authors the quotations are in general brief, too brief to be satisfactory.

There is a basic philosophical problem involved, whether historical coverage should try to be intensive or extensive, whether a smaller number of individuals studied in some depth is not preferable to a large number represented more superficially. There is a modern trend in texts to cover as much as possible, with a horror lest some person or some doctrine be omitted. This reviewer deplores such an attitude and believes that both pedagogy and historical appreciation are best served by a more selective and intensive approach.

Yet with all these comments it is very gratifying to have Dr. Long's book back in print. It is attractive, should make a considerable appeal to the general medical reader, and should stimulate him to go more deeply into medical history.

CHARAF ED-DIN. *Le Premier Manuscript Chirurgical Turc.* Paris, Roger Dacosta [1960]. 139 pp. 82.40 N.F.

Reviewed by NICHOLAS A. HALASZ, *Instructor and Resident, Department of Surgery, Yale University School of Medicine.*

ABULCASIS of Cordova (937-1013) wrote a medical-surgical encyclopedia which was to serve as an important source book of European and Near-Eastern authors for some five hundred years. It was a basically Galenical treatise, profusely illustrated, describing techniques and tools as well as diseases and medications.

The surgical portion of this manuscript was translated into Turkish by the court physician Charaf Ed-Din, who added commentaries and an entirely new set of illuminated miniatures. The opus was dedicated to his sultan, the liberal Mohammed II (The Conqueror) in 1465. This ruler had rejected the prevalent iconophobia of the era and encouraged reproduction of the human figure and face. Gentile Bellini was his court painter for a time. Thus illustrations depicting acts of healing were first made available with a Turkish text.

Turkish medicine arose from Chinese and Hindu roots. However, at the time of Charaf Ed-Din the influence of Byzantine, Armenian and, most importantly, Arab knowledge had become predominant. The empirical Turks of the Middle Ages were much like the Romans, compared to the Byzantines and Greeks, respectively—one practical and assimilative, the other analytical and philosophical.

This book presents the illustrated portions of the manuscript. The text, being basically that of Abulcasis, is not reproduced. However, a good, if brief, commentary on it is included. Abulcasis' Surgery is first described, then it is compared with Charaf Ed-Din's version. Both are put in the contemporary frame of reference, and the parallel phase of development in Europe shown. Also, there is adequate historical background given to point out innovations, omissions, and contrasting trends. For instance, the use of plaster is not mentioned in the manuscript for the therapy of fractures, although it had been known to the Arabs for some five hundred years. Great emphasis is placed throughout on the use of the cautery, contrasting with the otherwise Hippocratic therapeusis advocated.

The main theme of the book concerns the miniatures and their analysis. They represent a mixture of artistic influences, sharing Byzantine and classic, Alexandrian contributions. The traditional iconography and conventions of portrayal are Byzantine. It is mainly the stereotyping effect of the illuminating technique (Iranian) which sets these miniatures apart from contemporary murals in Greece and Crete. Otherwise they show the same approach to perspective, the same patterns of superimposition and deletion, albeit more clumsily and with less polish. The small format of the illustrations certainly contributes to this loss of quality.

There are no anatomical illustrations as such. Even in the paintings showing treatment the pathology in question is seldom and poorly shown. Unfortunately, no illustrations pertain to eye, maxillary, and dental surgery which was practised with considerable skill, as can be judged by the text.

Chinese influence is evident in the use of the cautery at distant symmetrical points for systemic disease. Acupuncture is not described, although pointed cautery-tips are often shown. The use of the technique strongly suggests an adaptation of moxibustion.

Judging by both text and illustration the mainstay of Turkish surgery of the era was plastic and reparative surgery. Internal elevation of nasal fractures, the cautery treatment of entropion, muscle-tightening for facial nerve palsy, the skilful use of traction and counter-traction in fracture management are some of the impressive contributions and adaptations described. In an aggressive, warrior nation the emphasis on traumatic surgery is understandable. However, laparotomies seem to have been rather commonplace for elective conditions, and layer-by-layer closure of the parietes was practised. Interruption of the temporal artery was the intriguing method used in the treatment of migraine.

The book itself is a bibliophile's delight. It is well printed and beautifully bound. The text is open and clear. It is nicely balanced by some 140 miniatures, superbly reproduced in color and black-and-white offset.

ZACHARY COPE. *Sir John Tomes: Pioneer of British Dentistry.* London, Dawsons of Pall Mall, 1961. ix, 108 pp., 11 figs. 25/-.

Reviewed by W. STUART HUNTER, *Assistant Professor of Dentistry, School of Dentistry, University of Michigan.*

SIR John Tomes certainly qualifies as a pioneer of British dentistry, and this volume about him is a welcome addition to the small but distinguished series of biographies by Sir Zachary Cope on Victorians in the healing arts.

Tomes displayed considerable versatility in his career and was engaged in research, teaching, invention, private practice, politics, and administration. His contributions include an accurate description and classification of the structure of the enamel of teeth in marsupials and in rodents, a classic description of the microscopic structure of human teeth, and some investigations of bone growth, each of which demonstrates his perception and acuity and stands unmodified today. The conclusions he came to, with relatively primitive research tools, were far in advance of his time. Indeed it is only recently, with the advent of electron microscopy, that many of these have been reaffirmed. His paper to the Royal Society on the dentinal fibrils is reproduced in full. As an inventor, he devised a number of instruments for the extraction of teeth and a machine for the carving of dentures from ivory by reproducing the contours of a cast. He was a strong advocate of the use of auxilliary personnel and in this as in other areas, seems to have been a true pioneer.

The account of his key role in the establishment of the Dental Register and the foundation of the British Dental Association and the Dental Board is factual and well documented. Tomes is reported to have been dignified, fair-minded, and a very hard worker with a rather humorless outlook. That the biography itself reflects these characteristics is a credit to its author.

It is regrettable that upon his death whatever private papers Tomes may have had were lost or destroyed so that this volume lacks the zest of Sir Zachary's studies of Sir Henry Thompson and of Florence Nightingale. However, it does collect under one cover all that is known of Tomes, and its author is to be commended for his scholarly presentation. The book includes a list of the most important dates in Tomes's life and several excellent illustrations, including reproductions of the drawings for his paper on dentinal fibrils.

ROBERT P. MULTHAUF. *A Catalogue of Instruments and Models in the Possession of the American Philosophical Society.* Philadelphia, The American Philosophical Society, 1961. xi, 80 pp., 26 illus. $1.50.

Reviewed by LAWRENCE BADASH, *Ph.D. Candidate, Department of the History of Science and Medicine, Yale University.*

THIS thin volume is a welcome addition to the few catalogues of philosophical apparatus collections in the United States. Unlike such predecessors as I. B. Cohen's *Some Early Tools of American Science* (Cambridge, Mass., 1950), which describes the Harvard collection, and Leland A. Brown's *Early Philosophical Apparatus at Transylvania College* (Lexington, Ky., 1959), Multhauf's book describes also technological devices, of which the American Philosophical Society fortunately possesses a number of models. There are examples of stoves, fireplaces, a blast furnace, a locomotive boiler furnace, boats, a mowing machine, a cheese press, a bridge, a pile driver, a wind-driven carriage, an elevator, etc. Such models were either presented directly to the Society by their inventors or submitted for various awards, such as the Magellanic Premium, a prize established in 1786 by a Portuguese member of the Royal Society of London for "the author of the best discovery, or most useful improvement, relating to Navigation or to Natural Philosophy, mere Natural History only excepted."

This catalogue is no bare listing of the APS collection. In addition to the pertinent details of provenance and description, are chapter introductions which give some background material to enable the reader to gain more than esthetic or antiquarian appreciation of the collection. Short sections on Early Museums of Instruments and Models, and The American Philosophical Society itself are also included.

The objects, other than technological, possess additional significance since the Society was this country's earliest attempt at an imitation of the great European national academies. Moreover, the APS is still alive and this large instrument collection dates from its youth.

Of special interest is a transit telescope, built by America's earliest instrument-maker of distinction, David Rittenhouse, which "may be the oldest extant telescope made on this continent." The statement (p. 10) that this instrument was used during the 1769 observations of the transit of Venus across the sun's face should be qualified. A *meridian* transit telescope, such as this, is normally fixed to move only in the plane of the meridian and would therefore be unsuitable to follow a *planetary* transit of a few hours' duration. Its use was probably confined to determination of astronomical time by observation of the sun's passage across the meridian. Knowledge of the longitude enables local noon to be converted to Greenwich time, which could be used to set precision-built grandfather clocks. This collection contains two such chronometers used in 1769, one built by Rittenhouse for his observatory at Norriton, and the other by Edward Duffield, a Philadelphia clockmaker. A few European refracting

telescopes, notably those by Peter Dolland of London (received in 1784) and G. S. Plössl of Vienna, are also described.

One should perhaps raise seriously the question of how carefully this collection was originally catalogued, and with what conviction we may regard the historical claims made for certain items. A case in point may be the garden sundial described on page 51. From its inscription, it was made in 1725 by John Iles, an otherwise unknown artisan, and received by the APS in 1956, having been "traditionally associated with Benjamin Franklin, by the family of the donor." Benjamin Franklin apparently has as many pieces of philosophical apparatus attributed to him as George Washington has beds. It often seems sufficient that an object be constructed in the eighteenth century, as, for example, a Leyden jar in the New Haven Colony Historical Society marked "used by Franklin and Priestly [*sic*] in electrical experimenting." Certainly, a serious examination of the authenticity of all such Frankliniana would be most valuable.

The year 1838 seems to be a dividing date, before which the contents of the instrument "cabinet" were intended to be used by the Society's members, and after which they were considered scientific memorabilia. In effect then, the earlier pieces are representative of the science of the day, while the later ones relate "more to the history of the Society than to the history of science and technology."

The collection is fairly representative of the physical sciences. It is curious, however, that there is no vacuum pump. The APS natural history specimens, presently on loan to the Academy of Natural Sciences of Philadelphia, are not here described.

Despite a few inconveniences, such as lack of an index, incomplete cross-references (there is no reference in the text to the globe and electrical machine shown in the interesting frontispiece portrait of Jefferson), and the distance of the plates from their textual descriptions, this book is enjoyable and worthwhile.

JOHN MAXSON STILLMAN. *The Story of Alchemy and Early Chemistry.* New York, Dover Publications, Inc., 1960. xiii, 566 pp. $2.45.

Reviewed by RHODA RAPPAPORT, *Instructor, Department of History, Vassar College, Poughkeepsie, New York.*

HISTORIANS of science all too often view their subject from the vantage point of the twentieth century rather than from the perhaps more elusive one of particular periods in the past. "Whiggism"—i.e., judging the past in terms of the present[1]—is sometimes adopted unconsciously, or may be a guiding principle which leads some historians to resurrect the work of obscure but prescient writers while ignoring others who have been influential but "wrong" in their views. In his survey of chemical theory and

[1] Cf. Butterfield, H. *The Whig Interpretation of History.* London, 1959.

practice from ancient times through the Chemical Revolution, John Maxson Stillman's aim was to tell his story "in a connected and systematic way . . . by placing the emphasis upon such discoveries and speculations as have made a decided impress on the growth of science" (page vi). Fortunately, however, the author was usually able to resist the pull of Whiggism implicit in this statement, with the happy result that *The Story of Alchemy and Early Chemistry*, although first published in 1924,[2] remains one of the best and most detailed treatments of a difficult subject.

Despite Stillman's avowed purpose, he made little attempt, particularly in the first chapters, to select those features of ancient and medieval thought and practice which made a "decided impress" upon the subsequent history of chemistry. Long citations from recipe books, manuals of the chemical arts, and philosophical works are all included to present a full picture of the diverse traditions from which chemistry emerged. With the great multiplication of sources since the sixteenth century, the author was forced to become rather more selective, but all of the major and an astonishingly large proportion of the minor figures are nonetheless treated at some length; even such verbose writers as Albertus Magnus and Paracelsus are cited *in extenso*, his theory of the elements explained by Nicholas Lémery, the nitro-aerial spirit described by John Mayow, and the phlogiston theory critically examined by Lavoisier. (Almost the only important figure who does not speak for himself is Georg Ernst Stahl whose incredible style apparently defeated even Stillman). The passages are so carefully chosen that interpretation by the author has often been kept to a minimum. The frequency of quotations from the original sources is in fact the most valuable and attractive feature of Stillman's book. In a period when the history of chemistry had barely been explored, Stillman had few guides—he did make use of studies by Berthelot, Kopp, Lippmann, and others—except his own thorough knowledge of the sources, impressively summarized in a long bibliography (pp. 541-554).

It is unfortunate that so useful a volume should contain a relatively large number of flaws which careful proofreading could have eliminated. (They are also present in the first printing and would presumably have been minimized had the author not died prematurely in 1923.) On page 443, for example, the Macquer bibliography is completely inaccurate; "Duhamel de Morveau" (p. 442) is Duhamel du Monceau (1700-1782); the "two" Geoffroys (pp. 442, 504) are both Étienne-François Geoffroy (1672-1731); and there are irritatingly inconsistent uses of latinized names (Grosseteste and Greathead; Arnaldus de, Arnaldus of, and Arnald of Villanova). An "error" of a different variety is Stillman's one notable lapse into Whiggism in his treatment of the phlogiston theory, which he described as both "the first coherent and plausible explanation of all

[2] Stillman, J. M. *The Story of Early Chemistry*. New York and London, D. Appleton and Company, 1924.

those phenomena which are now known as oxidation and reduction, direct and indirect," and, at the same time, an "obstacle . . . to chemical development" (p. 428). The judgment that this theory obstructed progress is certainly unhistorical and even contradictory to evidence, as Stillman himself virtually admitted in a later paragraph (p. 429).

Despite the minor imperfections cited, and despite the modifications suggested by more recent research, the value of Stillman's pioneer work is still relatively unimpaired. Almost forty years after the author's death, it would be difficult to find a comparable volume combining readability, sound scholarship, and reliably balanced judgment.

BRUNO VALENTIN. *Geschichte der Orthopädie.* Stuttgart, Georg Thieme Verlag, 1961. xiv, 288 pp., 142 illus. $9.45.

Reviewed by ULRICH H. WEIL, *Instructor, Department of Orthopaedic Surgery, Yale University School of Medicine.*

IN conversations with students, residents, and even with some of my colleagues, I have been frequently impressed by the fact that few possess knowledge of the historical background of orthopaedic surgery. As a result of this unawareness, many contemporary papers are only repetitions of ideas which have been reported in the past. It is true that up until now it has been quite a problem in our specialty to find publications which deal with its historical aspects. With the exception of Bick's *Sourcebook of Orthopaedics,* Keith's *Menders of the Maimed,* occasional chapters in orthopaedic textbooks, and scattered articles in journals, this material is not easily available.

The gap has now been closed by Valentin's *Geschichte der Orthopaedie.* In 276 pages a well-rounded picture of the development of orthopaedic methods, and of the men who have been responsible for them, is given. Starting with the beginning of recorded medical facts, this history extends to the first years of the twentieth century. The volume is divided into two parts. The first section deals with orthopaedic problems in the order in which they become amenable to treatment. It covers deformities and diseases of the spine, club foot, torticollis, congenital dislocation of the hip joint, poliomyelitis, and cerebral palsy. These chapters are followed by those on the development of tenotomies, oteoclasis, and osteotomies. On reading this section one is repeatedly impressed by the fact that some of the procedures which we still use today have been performed in a rather similar fashion for hundreds of years.

The second part presents the development of orthopaedic surgery as a specialty in England, France, the Netherlands, Switzerland, Germany, Austria, the Scandinavian countries, Italy and the United States. In these chapters short biographies of the leading men, both physicians and non-professionals, responsible for the advancement of orthopaedic knowledge are given. Their influence on the recognition of hitherto unknown etio-

logical factors and on the invention of new methods of treatment are discussed. The development of orthopaedics in England is especially interesting and well written.

The breadth of Dr. Valentin's knowledge is amazing. A lifetime of research must have gone into the evaluation of quotations from more than 1,150 sources which he has been able to trace in their original Greek, Latin, German, English, French, Italian and Dutch languages.

It seems presumptuous to criticize a work of this scope, but one still misses some historical background material on generalized disorders of bone and on the osteomyelitides. The chapters on orthopaedic surgery in Germany and Austria seem less satisfactory than those on other countries. It is difficult to do justice to this subject by presenting the history according to orthopaedic institutions instead of giving the development in chronological order, as Dr. Valentin has done with France or the United States, for example.

But these omissions and small shortcomings are of a minor nature. All in all, this is a book which no one interested in orthopaedic surgery should miss. Numerous illustrations add to its attractiveness. To paraphrase a quotation from the book's preface: A solid knowledge of history is of great value to research, either to save time and effort by not re-inventing methods which have been used before, or to keep alive ideas which might lead to further improvements. The publishers would perform a great service by preparing an edition in English of this volume.

NINA RIDENOUR. *Mental Health in the United States, a Fifty-Year History.* Cambridge, Harvard University Press, 1961. xii, 146 pp. $3.50.

Reviewed by JOZEF PH. HES, *Research Fellow in Social Psychiatry, Department of Psychiatry, Yale University School of Medicine, New Haven, Conn.*

THIS book contains in a few pages a wealth of information concerning the origin and development of the mental health movement in the United States. In a very vivid way the author describes the humble though prophetic beginnings of Clifford Beers's actions.

From the improvement of the care of mentally ill patients as the first station the reader is gradually carried on an extensive journey in the field of mental health. Psychiatry arises as a mighty force and appears publicly as the spokesman not only of the hospitalized patients but of many other underprivileged: the children, especially the mentally retarded; the soldiers who broke down in war efforts.

The mental health movement breaks through the wall which divides professionals from non-professionals. It appeals to the legislature and succeeds in changing the laws regarding mental patients. By means of the mass media such as printing press, television and radio the individual is reached. The movement expands from New Haven, Connecticut, to all

over the United States of America and eventually becomes a world organization. It is often amazing to see how much has been accomplished in fifty years. The author, who is well qualified to write a history of the mental health movement, participated actively in many of the events she describes. She has been a clinical psychologist and later a professional staff member of mental health associations.

She succeeds extremely well in transmitting the message that though much has been accomplished, still there is no justification for slackening. ". . . there is still only one doctor to nearly two-hundred patients in our big mental hospitals, an average of well under an hour of a doctor's time per patient per month."

Although the public attitude towards mental illness and mental health has changed considerably during the last fifty years, and recent studies confirm this observation, much is yet to be done. It is the subject of mental disease itself that still evokes much resistance and much anxiety.

The book is intended for "those who already have some degree of concern about the subject and know at least something about it. More specifically, it is for the boards, staffs, volunteers, and members of mental health associations; for students in the medical, social and behavioral sciences; and for professional workers in mental health and related fields."

LORIS PREMUDA. *Storia della Medicina.* Padova, CEDAM, 1960. 277 pp.

Reviewed by GEORGE MORA, *Medical Director, Astor Home for Children, Rhinebeck, New York.*

LORIS PREMUDA is a young and well-known representative of the contemporary Italian school of the history of medicine. Originally trained in clinical medicine, he has been a pupil of Pazzini in Rome, has taught the history of medicine at the University of Ferrara, and is now the head of the Institute of the History of Medicine at the University of Padua, a position formerly held by Castiglioni.

The present volume is one of a series of several manuals which have recently been published for medical students by members of the Faculty of Medicine of Padua. Its purpose, therefore, is limited to a simple presentation of the whole field of the history of medicine in a pocket edition of less than 300 pages. Dr. Premuda has fulfilled his goal in a remarkable way. The content of the volume is divided into 16 chapters, which cover the development of medicine in chronological order from paleopathology to the contemporary schools. The first chapter, introductory in its aim, offers an up-to-date review of the historiography of medicine, its development, its scientific institutions, and its most illustrious representatives. It contains a number of methodological remarks which were previously published by the author, more in detail, in a separate monograph (*Medicina in Relazione alla Metodologia ed alla Scienza,* Padua, CEDAM, 1955). Two chapters are dedicated to primitive medicine, followed by another two on

Oriental, pre-Columbian, and early Greek medicine. The seven chapters on Greek, Roman, Medieval, and Renaissance medicine, which constitute the main part of the volume, offer a clear and well-balanced presentation of the development of western medicine according to classic medical historiography. More original is the presentation of medicine of the Baroque, to which the author has contributed in previous publications. Finally, the last three chapters deal with the development of medicine in the last three centuries, from Boerhaave to Sir Alexander Fleming.

The author's preoccupation with facts and data (of early experiments, discoveries, etc.) contributes to the fragmentary character of these last chapters. It is this reviewer's impression that consequently they will be less easy to read than the early chapters, especially for junior medical students. For senior students, already familiar with clinical entities, Dr. Premuda's book will constitute a very useful historical survey. This emphasis on clinical entities, evident throughout the whole book, is offset by the absence of a broad cultural viewpoint, an absence particularly pronounced in the last chapters. But this more ambitious aim could hardly have been achieved within limits of a students' manual. Apart from this point, the information is accurate and up to date, although the choice of material offered is at times arbitrary. The emphasis on the Italian literature—as in Castiglioni's *History of Medicine*—has to be viewed as an expression of the interests of the author in the physicians of his own country. More difficult to justify is Premuda's emphasis on his own, or on his school's, contributions to the history of medicine and the lack of well-balanced and precise bibliographical references throughout the whole volume. But these are only minor deficiencies in this manual, which appears to have met the purpose of the Faculty of the School of Medicine of Padua—to integrate the history of medicine into the curriculum of the medical students, a purpose which we would like to see achieved in each medical school.

JOHN COLLOP. *The Poems.* Conrad Hilberry, Ed. Madison, University of Wisconsin Press, 1962. xii, 227 pp. $5.50.

Reviewed by F. N. L. POYNTER, *Librarian, The Wellcome Historical Medical Library, London, England.*

JOHN Collop, a hitherto little known poet-physician of the seventeenth century, was introduced to readers of this journal in October 1956 in two articles by Dr. Hilberry and the present reviewer. This first modern edition of Collop's poems is the fruit of prolonged study by its editor, who has collated the known copies of *Poesis Rediviva* (1656) and *Itur Satyricum* (1660), included Collop's corrections, and provided explanatory and textual notes.

Collop took as his models the verse of Donne and Herbert but his own, except for some of the religious lyrics, never reaches the same level, although

it has a harsh attraction not unknown in some present-day verse. The chief interest of this volume for us is, of course, the long section of 24 poems on medical topics, among them the poem *On Doctor Harvey*. When this was reprinted in 1956, it was thought to be the earliest reference to Harvey in English literature, but one even earlier has now been reported by Richard Hunter (see p. 403).

The excellent introduction contains all the known facts of Collop's life, the dates of which can now be extended from 1625 to at least 1676, for a recently noticed marriage license reveals that in that year he was married in London for the second time.

The work is attractively printed and produced and is a welcome addition to the slender series of English medical poets.

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Hygiene and Preventive Medicine in Ancient China

JOSEPH NEEDHAM* and LU GWEI-DJEN**

Introduction

MUCH has been written in western languages (not all of it very well informed) on the history of medicine and the allied sciences in the Chinese culture-area. In the course of work now in progress on a general history of science, scientific thought, and technology in that civilization, we are making a study of the most important contributions of Chinese thought and practice to medicine and the biological sciences throughout the historical period. This subject not only has great comparative significance for the history of biology as such, but it is also of some topical interest in that the Chinese today are making a great effort to recover and validate all that was of value in their own cultural heritage in this field. They are systematically investigating the contributions of the past in the hope of integrating them into a modern medical science.[1]

Here we should like to offer to the readers of this journal some observations on the historical concepts of hygiene and preventive medicine in Ancient China. By this we have in mind mainly the period down to the end of the Han (*ca.*+200). After that time Indian influence, entering China with Buddhism, brought considerable foreign importations in medical philosophy, and these we shall not now consider. Moreover, in the early times the relations between medical philosophy and the thoughts of the writers on philosophy, ethics, and logic were especially close; for example, it is interesting that throughout the ages the duty of the Confucian literati to care for their parents according to the precepts of filial piety was a powerful influence in assisting the growth of medical science. It must, of course, be understood that we have to deal with ancient and early mediaeval conceptions

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[1] This situation contrasts rather sharply with that in India and Ceylon, as one of us (J.N.) had good opportunity of seeing during the spring of 1958. Ayurvedic medicine in the Indian culture area deserves just as careful study as that which Chinese traditional medicine is receiving, but unfortunately most of the Indian and Ceylonese traditional practitioners are unwilling to seek for any integration with modern western medicine. Thus the investigation by modern methods of the traditional pharmacopoeia and all the persisting traditional therapeutic procedures is rendered very difficult. It is easy to think of sociological reasons accounting for this difference between the Chinese and Indian culture areas, and it is to be hoped that the inhibitions in the latter will soon be overcome.

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which in practice had only a limited application to the life of the mass of the people as a whole. Nevertheless, it is reasonable to believe that the success of Chinese culture in maintaining its characteristic ethos throughout so large a population over the centuries was in part due to the contributions of those who concerned themselves with hygiene and preventive medicine. With these considerations in mind and notwithstanding our chosen limitation of period, we shall not hesitate to quote from sources as late as the end of the Thang dynasty, (i.e., substantially from the whole of the +1st millennium).

Here we cannot enlarge upon the philosophy of Nature which was current among the ancient Chinese. It must suffice to say that this philosophy was based upon the idea of two fundamental forces, the Yang[a]* and the Yin,[b] the former representing the bright, dry masculine aspect of the universe, the latter, the dark, moist feminine aspect. This conception is probably not older than the −6th century.[2] Besides this, there had arisen from the school of Tsou Yen[g] in the −4th century the universally accepted doctrine of the Five Elements.[3] As is well known, these differ from the elements of the Greeks and other peoples in that they comprised not only fire, water and earth, but also wood and metal. Another doctrine prominent in ancient Chinese thought was that of the Macrocosm and the Microcosm.[4] A great interdependence of the State on its people, and of the health of the people on the cosmic changes of the Four Seasons was envisaged. The elements were associated together in "symbolic correlations" with many other natural phenomena in groups of five,[5] and these conceptions were applied in a remarkably systematic way to the structure and function of the living body of man. As might be expected in a society which was developing the characteristic form of bureaucratic feudalism, great importance was attached to the *prevention* of trouble, both in the political and personal life of the people, rather than to its control when it arose, and thus in the field of medical thought prevention was considered better than cure.

One further aspect of ancient Chinese nature-philosophy demands allusion here, namely the doctrine of pneuma (*chhi*[h] and

* The alphabetical superscripts refer to Chinese characters listed at the end of the paper.

2 Cf. Needham, vol. 2, pp. 273 ff. Ancient Chinese medicine was full of other antitheses, for example, symptoms manifested externally (*piao*[c]) or internally (*li*[d]), and fever (*jê*[e]) as against chill (*han*[f]).

3 Needham, vol. 2, pp. 243 ff.

4 Needham, vol. 2, pp. 294 ff.

5 Needham, vol. 2, pp. 261 ff.

fêng[i]). As Filliozat has shown in a classical monograph, the conceptions of Greek pneumatic medicine can be paralleled with much precision in the Indian ideas of *prana* found in the great Suśruta and Caraka corpuses. *Chhi*[h] and *fêng*[i] in China are nothing other, but the former at least cannot have reached China from India since it appears there too early; one wonders therefore whether a Babylonian influence did not (as in so many other cases) spread both east and west. While in later times (e.g. in the thought of the +13th-century Neo-Confucians) *chhi*[h] came to mean all forms of matter, from the most condensed to the most tenuous; in ancient China it referred rather to subtle matter (comprising what we should now think of as gases and vapours, radio-active emanations, radiant energy, etc.) and invisible biological influences (including nerve-impulses, hormonal actions, infection and contagion). In medical thought *chhi* was something like a vital force in living mind-body organisms, acted upon favourably or unfavourably by other *chhi* from the environment, but also itself sometimes capable of spontaneous malfunction. We shall come across the word *chhi*[h] very frequently in what follows, and like Tao[q] it is better left untranslated.

Ancient Chinese medicine was closely associated with the beliefs of the philosophers who may broadly be termed Taoist. In contradistinction to the Confucians who were interested primarily in human society alone, the Taoists devoted themselves to the study of Nature, believing that man's life should be lived in conformity with her, and they developed a system of religious mysticism which has been termed the only one ever known in the world which was not essentially anti-scientific. The Taoists believed in the possibility of attaining a material immortality so that they could continue to exist as etherealised beings on the earth, enjoying the beauties of nature.[6] For this purpose, they engaged in the study of alchemy, sought drugs which would confer longevity or immortality, and practised all kinds of techniques (some ascetic, some not) which they thought might contribute to this end. Their relation with preventive medicine was therefore particularly intimate. They spoke of the art of nourishing the life (*yang sêng*[j]), concentrating special attention on the inner causes

6 Needham, vol. 2, pp. 139 ff. It should be remembered that while later Taoism (after the third century) generated a veritable church, and lost itself in a maze of polytheistic superstition, the early Taoists, deeply engaged as proto-scientists with their "natural magic," were very practical men. And all their operations were conducted within the framework of a world-view which regarded the Tao[q] as essentially immanent—the Order of Nature itself.

of illness, which they pictured as the result of an improper balance between the Yin[b] and the Yang.[a] It was necessary to harmonize these two in order to remove the causes of disease. What the *Tao Tê Ching*[k] (Canon of the Virtue of the Tao)[7] calls "having a true hold on life" (*shê sêng*[l]) was their aim. To attain longevity and perhaps immortality, the "way of life" (*tao sêng*[m]), was to be pursued. It was necessary to practise "the nourishing of the mind and the emotions" (*ching shen ti hsiu yang*[n]) and to train the body to live in accordance with the cyclical changes of the four seasons (*ying ssu shih ti pien hua*[o]). One must have a normal and regular way of life (*chêng chhang kuei lü*[p]). It was thus believed that the life span of a normal person should be at least a hundred years. All these methods and techniques were grouped together under the term *wei sêng*[r] which may be translated without hesitation as what we mean by "hygiene," literally, "the protection of life." Besides the search for the elixir of immortality, and for drugs (often mineral) which would promote longevity, the other Taoist techniques (*shu*[s]) thought likely to contribute to that desirable end included various forms of gymnastics, special sexual practices, fasting and abstinence, and even exposure of the body to sunlight, moonlight, and wind. Many of the techniques, both of the Taoists and the ancient physicians, were necessarily mixed with beliefs in what we should today call magic. Nevertheless the practical benefits to health of much of what they recommended are undeniable.

EARLY CONCEPTS OF PREVENTION

We shall now present a series of texts illustrating these concepts from the Chou period down to the beginning of the Thang. It will be seen that the philosophers and the medical writers are at one on the subject. First of all, in the *I Ching*[t] (Book of Changes), the basic text of which goes back to the −7th or −8th century, we have the fundamental statement[8] that "the *chün-tzu*[u] (great-souled man)[9] always meditates on trouble in advance and takes steps to prevent it." Then in the *Tao Tê Ching*,[k] the great

7 Ch. 50.

8 Baynes tr., vol. 1, p. 261, the *hsiang chuan*[w] of the *kua*[x] Chi-Chi. This statement occurs in what is essentially a commentary of the -4th or -3d century.

9 Like Tao[q] and *chhi*,[b] we prefer to leave *chün-tzu*[u] untranslated. Though it originally meant the ruler or the lord in bronze-age proto-feudalism, it came to have all the aura of Aristotle's "great-souled man," or what is implied by the term "gentleman," even "knight," of aristocratic birth but not necessarily, a scholar but not necessarily, an officer of state but not necessarily. For Westerners, Sir Thomas More might be cited as the type of all *chün-tzu*.[u]

poem attributed to Lao Tzu[v] which we have already mentioned and which may date from about the —4th century, we have the following verse:[10]

> To know when one does not know is best;
> To (think) one knows when one does not know is a disease.
> Only he who recognizes this disease as a disease
> Can prevent himself from having such diseases.
> The sage does not suffer from these affections;
> He recognizes his (incipient) diseases as diseases
> And therefore does not have them.

Here we have the recognition of abnormal functioning at its small beginnings and of causes bodily as well as mental. It is interesting that the conception should be applied to what modern science also recognizes as the worst of all intellectual diseases.

Coming now to the early Han period we have the following statement in the *Huai Nan Tzu*[z] book compiled about —120, by a group of scholars and proto-scientific magicians under the patronage of the Prince of Huai Nan, Liu An.[aa] There we read[11] "A skilful doctor cures illness where there is no sign of disease, and thus the disease never comes" (*liang i chhang chih wu ping chih ping, ku wu ping*[ab]).

To this period belongs the greatest of all the Chinese medical classics, the *Huang Ti Nei Ching, Su Wên*[ac] (The Yellow Emperor's Treatise on Internal Medicine; the Pure Questions and Answers). The date of this work has given rise to a great deal of discussion but we may accept it as being mainly of the early Han period (—1st and —2d centuries), though of course with some later interpolations. In one of the earliest chapters of this book, we find the statement:[12] "It is more important to prevent illness than to cure the illness when it has arisen" (*fang ping chung yü chih ping*[ad]); and in an adjacent place we read,

> The sage does not cure the sick only when they are sick but he prevents the illness from arising. In the same way he does not put right upheavals in the body politic, he prevents them from ever taking place. Surely it is too late to administer drugs after the illness has declared itself or to try to suppress a revolt after it has come about. Is it not like beginning to dig a well when one feels thirsty, or starting to manufacture weapons of war after the battles have begun?

10 Ch. 71. We diverge from the translation of Waley. The extremely laconic and epigrammatic quality of this famous text may be appreciated from the text of the last three lines: *Shêng jen pu ping, i chhi ping ping, shih i pu ping.*[y]

11 Ch. 16, p. 4b.

12 Ch. 2, p. 12b.

To this we may add a statement from another book of great fame, the *Chin Kuei Yao Lüeh*[ae] (Systematic Treasury of Medicine)[13] written by the "Chinese Galen," Chang Chi[af] (Chang Chung-Ching[ag]), about +200: "Someone asked: 'What is meant by experts when they speak of "curing a disease before it appears?" ' The teacher replied: 'When one observes a disease of the liver and knows it will spread to the spleen, it is wise treatment to strengthen the latter first.' "

Aphorisms of this kind may be found also in the *Pao Phu Tzu*[ah] book written by the great alchemist and physician, Ko Hung,[ai] in the close neighbourhood of +300. He says:[14]

Thus the adept disperses troubles before they begin, and cures diseases before they show any symptoms at all. The prescriptions of physicians are best given before any serious signs have appeared; then it will not be necessary to run after the disease when the patient is already dying.

And in the works of the great physician Sun Ssu-Mo,[au] of the +7th century, we find the following words:[15]

After enjoying excellent health for ten days, it is advisable to employ moxibustion at the *san shu*[aj] point[16] in order to expel noxious humours. Day by day it is necessary to harmonize the *chhi*[h] and nourish the body. But massage and gymnastics is best of all. In time of health (lit. peace) do not forget danger. Always try to prevent the coming of disease beforehand.

And finally, there is an interesting passage in the *Ho Kuan Tzu*[am] (Book of the Pheasant-Cap Master). This is a very mixed compilation of a philosophical character, many parts of which date from as early as the −3d century but which was added to from time to time and did not reach the form in which we have it now until the +3d or the +4th century. One of the discussions there recorded[17] (we need not insist too much upon its historical certainty) is between Chao,[an] the prince of Cho-Hsiang,[ao] the son of Duke Hsiao[ap] of the State of Chao,[an] and his general, Phang Nuan.[aq]

Phang Nuan said to the prince of Cho-Hsiang, "Have you not heard that Duke Wên[ar] of Wei[as] State asked the great physician, Pien Chhio,[at] saying, 'Of your three brothers, which is the best physician?' Pien Chhio answered, 'The eldest is the best, then the second, and I am the least worthy of the three.' Duke Wên said, 'Might I hear about this?' Pien Chhio replied, 'My eldest brother treats diseases in a most godlike way. Before the disease has

13 Ch. 1, p. 1a.
14 *Nei Phien*,[ak] ch. 18, p. 5b.
15 *Pei Chi Chhien Chin Yao Fang*,[al] ch. 27 (pp. 481-482).
16 The "point" named is one of the numerous points on the surface of the body where needles were inserted in acupuncture or mild moxa cautery employed.
17 Ch. 16, pp. 10b. ff.

shown any symptoms, he has already got rid of it. Thus his fame never reached beyond our own clan. My next brother also treats disease very exactly and precisely, so his name has not become known beyond our own district. As for myself, I practise with needles, I examine the pulse and I prescribe drugs, in addition to which I have insight into what is happening between the skin and the flesh. Thus my name has become known among all the Princes of the Kingdoms and all the Feudal Lords.' "

Before going further, it is interesting to return to Sun Ssu-Mo[au] in the +7th century and to learn that he suggested the universal provision of what we should now call first-aid kits. In his *Pei Chi Chhien Chin Yao Fang*[al] (The Thousand Golden Remedies for Emergency Use) he recommended[18] that people, whether at home or travelling, should always have medicines ready. They should have moxa (*shu ai*[av]) for moxibustion, various kinds of emergency pills, rhubarb, mercury, *kan-tshao*,[aw] *kuei-hsin*,[ax] etc., ginger and other drugs handy for making up prescriptions. In addition to this, every large family should possess one or two treatises on emergency medicaments.

Ancient Literature

Before proceeding further, it will be desirable to have a look at certain interesting specimens of ancient literature in the Chinese tradition; first, the *Chou Li*[az] and secondly, the *Shan Hai Ching*.[ba] The *Chou Li*[az] (Record of Institutions of the Chou Dynasty) is a large and interesting work compiled by scholars of the early Han Dynasty and to be dated about the −2d century. It purports to be a register of the officials and their duties under the High King of the Chou Dynasty, namely, the period in the middle of the −1st millenium. It cannot, however, be a record of actual facts of that date but constitutes rather a system showing what the Han Confucian scholars considered the ideal form for a unified Chinese imperial bureaucracy. Some parts of the book, especially the *Khao Kung Chi*[bb] (Artificers' Record) are probably genuine documents going back to the −4th century or a little before, in this case from the State of Chhi,[bc] but the greater part of the work is essentially Han.

Now the interest of this compilation in the present context is the detailed account of the medical and health officials attached to the imperial court. It is immediately interesting from the hygienic point of view to find not only an Imperial Physician (I Shih[bd])

[18] Ch. 27, (p. 411.2).

who superintends the imperial medical staff,[19] but also an Imperial Dietician[20] (Shih I[be]). His duties and those of his assistants were to take charge of the diet of the emperor and the court, bearing in mind the nature of the various foods to be combined into a balanced diet and adapted at the same time to the cycle of the seasons. Besides these (and it is interesting that the Imperial Dietician comes next in order to the Imperial Physician), there was the Physician-in-Ordinary for Internal Medicine (Chi I[bf]) who dealt with the infections and epidemics characteristic of the four seasons, certifying and recording causes of death as well as applying remedies to the sick;[21] and the Physicians-in-Ordinary for External Medicine (Yang I[bg]). These officials cannot quite be called surgeons because they rarely operated, but their domain concerned war wounds and fractures as well as ulcers and oedemas.[22] Lastly came the Imperial Veterinarian (Shou I[bh]) and his staff.[23]

In addition to all these groups, however, there are quite a number of sanitary officials whom we might call "fumigators" or "vermin exterminators." For example, the Chu Shih[bi] is charged with combating poisonous parasites harmful to man (*tu ku*[bj]) using drugs in the form of smokes, but also conjurations.[24] Similarly, the Chien Shih[bk] is charged with combating insect pests (e.g. silver fish, moths, boring beetles, ants, termites, and so on).[25] Again conjuration plays a part as well as fumigation and there is mention of the plant *mang*[bl] (*Illicium religiosum*, the bastard anise).[26] This was a well-known poison for insects and fish in antiquity. We find, for example, in the *Huai Nan Wan Pi Shu*,[bm] an interesting collection of recipes attributed to the group of experts surrounding Liu An,[aa] the Prince of Huai Nan, and very reasonably attributable to that date (−120), the statement that *mang tshao*[bn] is a powerful fish poison (*mang tshao fou yü*[bo]).[27] Returning to the *Chou Li*,[az] the Chhih Pa Shih[bp] is charged with combating vermin in walls and houses;[28] for this purpose he uses

19 Ch. 1, p. 4a; ch. 2, p. 1a. All the passages referred to in this paragraph will be found in the Biot tr., vol. 1, pp. 8 ff., 92 ff. The reason why each official has two references is that he and his staff are mustered in one chapter, while the description of their duties is given in another.

20 Ch. 1, p. 4a; ch. 2, p. 1b.

21 Ch. 1, p. 4b; ch. 2, p. 2a.

22 Ch. 1, p. 4b; ch. 2, p. 3a.

23 Ch. 1, p. 4b; ch. 2, p. 4a.

24 Ch. 9, p. 5b; ch. 10, p. 7a. All the passages referred to in this paragraph will be found in the Biot tr., vol. 2, pp. 386 ff.

25 Ch. 9, p. 6b; ch. 10, p. 8b.

26 Read, no. 505; Stuart, p. 489.

27 Entry no. 53. Cit. in *Thai-Phing Yü Lan*,[bs] ch. 993, p. 2b.

28 Ch. 9, p. 6b; ch. 10, p. 9a.

lime prepared from mollusc shells and "scattered ashes," words which may conceal the use of caustic alkali prepared by the burning of wood and the "sharpening" of its lye. Then the Kuo Shih[bq] has the duty of combating insects which make disagreeable noises such as frogs or cicadas.[29] Fumigation again occurs here with the very significant use of *mu chü*[br] (*Pyrethrum seticuspe*, the winter aster)[30] both for sprinkling as powder and also as fumigatory smoke. Although the use of *Pyrethrum* has come down to us in the present text in connection with frogs and cicadas, this is probably only a chance and we cannot but take notice of the interest of the fact that such a valuable plant insecticide is mentioned among the paraphernalia of the sanitary officials in the *Chou Li*.[az] Lastly, the Hu Cho Shih[bt] had to get rid of aquatic pests (*chhung*[bu]).[31] He beats pottery drums and throws burning stones (or perhaps burnt stones, lime?) in order to frighten them away, and he is concerned with the magic of elm-wood branches and elephant teeth. We are obviously here in the presence of a mixture of ancient magic and effective insecticides. At the least it remains remarkable that this ideal if somewhat archaized reconstruction of what was imagined to be the perfect governmental staff includes so many sanitary officials.

Indeed, this was not the end of them. Elsewhere in the same book we meet with the waterways police[32] (Phing Shih[bv]). Their duty was to warn of dangerous places as well as protecting fisheries out of season. They might thus be considered to be concerned with public safety in more senses than one since there are not a few species of fish in Chinese waters which are poisonous at certain seasons of the year. More directly important for our present subject, perhaps, are the sanitary police[33] (Chhü Shih,[bw] the word *chhü* here meaning a rotting corpse, or maggots therein). This official and his staff are charged with the removal of all rotting corpses whether of men or animals. When someone dies on the road, they have to bury the body and report to the magistrate on the day and month of the event, bringing the clothes and possessions of the deceased, with a view to the reclaim of the latter by his or her family. Last of all come the Yeh Lu

29 Ch. 9, p. 6b; ch. 10, p. 9a.

30 Read, No. 26; Stuart, p. 260; Bretschneider, vol. 2, nos. 130, 404. *Pyrethrum* is mentioned again, and in the same context, in the 2d century *Huai Nan Wan Pi Shu*,[bx] (entry no. 107); cit. in *Thai-Phing Yü Lan*[by] ch. 996, p. 2b.

31 Ch. 9, p. 7a; ch. 10, p. 9b.

32 Ch. 9, p. 5a; ch. 10, p. 4a. All the passages referred to in this paragraph will be found in the Biot tr., vol. 2, pp. 380 ff.

33 Ch. 9, p. 4b; ch. 10, p. 3a.

Shih[bx] or traffic police[34] whose duty was to inspect communications, direct traffic both on streets and waterways, keep rest-houses in good condition, conduct visitors to and from the frontiers and —again for us important—to organize the sweeping of the streets in the capital and other cities. Thus there is a great deal of interest from the point of view of preventive medicine in this ancient survey of the ideal imperial bureaucracy.

It is always difficult to be sure how far the organization described in the *Chou Li*[az] refers only to the imperial capital and the imperial court itself and how far it was regarded as extending outward in a provincial network throughout the whole of the country which owed allegiance to the High King or Emperor. The question is somewhat academic for the Chou period itself because this elaborate organization never existed during that period. But during the early Han period, when the compilation was actually being made, there was growing up a highly bureaucratic organization of prefectures and commanderies all over the Empire subject to the one universal monarch, the imperial head of the whole Chinese *oikoumene*. Thus we may interpret the meaning of the scholarly writers of the *Chou Li*[az] as having regard to the bureaucracy throughout the provinces as well as in the capital itself. Of course, some of the officials such as the imperial medical staff were primarily those attached to the court.

Another ancient literary work of equal interest is the *Shan Hai Ching*[ba] (Classic of the Mountains and Rivers), a work which has sometimes been described as the oldest geographical treatise of China. It is a very archaic text going back at least as far as the —4th century, but it contains some material far older than that, perhaps even in origin as old as the Shang. This book is ostensibly a geographical account of all the regions of the Chinese culture-area. It contains indeed a good deal of mythological material about strange beings, gods and local spirits who were worshipped in different places, yet the tone is surprisingly matter-of-fact and the material includes a large quantity of very rational descriptions, for example, the minerals found in different places are recognized, the kinds of trees and animals found there, and the difficulties of communications. Now when we look at what is said of herbs and minerals in this treatise, we find, rather surprisingly perhaps, that the idea of prevention rather than cure is outstandingly present. The *Shan Hai Ching*[ba] usually recommends particular

[34] Ch. 9, p. 4b; ch. 10, p. 2a.

drugs, not for curing diseases but for preventing their onset. No less than sixty items of this kind are stated to promote health and to prevent illness. The word *fang*,[by] which we might translate "will ward off," is extremely prominent here. The agents and measures referred to are shown in Table I.

TABLE I

Preventive Medicine in the *Shan Hai Ching*[ba]

Agent or Measure	*fu chih*[cc] to use in one way or another on the body	*shih chih*[cd] to use by ingesting
Prevention of infection by parasites (worms or insects) (*ku*[ca] poison) (*fang ku*[ce])	8	5
Prevention of epidemic or infectious diseases (*fang i*[cf])	4	3
Promotion of health (*chhiang chuang*[cg]) by preventing hunger or avoiding emotions such as fear and jealousy	25	8
Protection against external disease of the sense organs (*fang wu kuan ping*[ch])	8	5
Protection against external diseases of the skin and limbs (*fang phi fu wai kho chu ping*[ci])	8	7
Protection against internal affections viscera, etc.) (*fang tsang chhi chu ping*[ci])	4	2
Prevention of conception (*pi ying*[ck])	2	1
Protection of animals from disease (*fang shou ping*[cl])	1	0
TOTAL	60	31

Apart from the terms mentioned at the head of the columns in this table, the text also speaks of *phei chih*,[bz] meaning to wear the object; and very occasionally, to pay homage to it or worship it. The interest of this analysis is that one can see the kinds of diseases which were feared in the Warring States period especially by travellers. No doubt Fan Hsing-Chun is right in believing that "*ku*[ca] poison" was schistosomiasis and that one of the chief diseases listed under affections of the sense organs, *mi*,[cb] was probably trachoma. One can also visualize the great extent of forest country and uncultivated waste land in those days by the fact that so many animal substances rather than plants are mentioned. We may make a table according to this breakdown as follows (Table II).

We thus see how 31 items were actually eaten for protection and only a slightly less number used in other ways such as being worn on the body or being smeared over the body. It is also noteworthy that the idea of the promotion of general health in accordance with the Taoist principle of "conserving the life" (*yang sêng chih tao*[cm]) appears in the third item of Table I above, namely, the general promotion of health, both mental and physical. The promotion of mental health is indicated by the fact that in certain cases the advantageous effect of the medicament is

TABLE II

Materia Medica in the *Shan Hai Ching*[ba]

Mammals	5	Herbs	10	Minerals	1
Fish	13	Shrubs	12		
Birds	9				
Reptiles	2				
TOTAL of vertebrate animals	29	TOTAL of plants	22		

said to lie in removing fear of storms, thunder, wild beasts, etc. It is very likely that maintenance and improvement of good nutritional status were an important function of the items in group 3, for no better means would have existed for keeping in good heart those ancient travellers, official, military or private, through the wild mountains and forests between the isolated and far scattered urban foci of ancient Chinese culture. Thus in general one can see how the *Shan Hai Ching*[ba] represents a more archaic stage in the development of materia medica in China than the *Shen Nung Pên Tshao Ching*,[cn] the first of the long line of pharmacopoeias (*ca.* +1st century).

Whether there were many written manuals of public health and the prevention of disease in the Warring States period, we do not know. Certainly none has come down to us. There is, however, the possibility of seeing a reference to such manuals in one of the stories of the *Chuang Tzu*[co] book written by Chuang Chou about −300. There he is speaking[35] of an interview between one of the disciples of Lao Tzu,[v] Kêngsang Chhu,[cp] and an inquirer, Nanjung Chu:[cq]

> Nanjung Chu said, "What I hear about the Great Tao makes me feel like a patient taking medicine and his illness being intensified thereby. What I would like to hear about are the (teachings of the) manuals on the protection and preservation of life (*wei sêng*[r])."

35 Ch. 23; *Chuang Tzu Pu Chu*,[cs] ch. 8A, p. 9a.

Here the expression actually used is *wei sêng chih ching*[cr] and although this can be translated as "the standard methods of guarding and preserving life", it is not at all impossible that actual written manuals are referred to.

In later times, the expression *wei sêng*[r] was employed in the titles of many medical books but generally with a rather wider implication. One might mention, for example, the Sung book, *Wei Sêng Shih Chhüan Fang*,[cs] (Perfect Prescriptions for Preserving Life) by Hsia Tê-Mou,[ct] or another book, by a medical writer of the Yuan dynasty, the *Wei Sêng Pao Chien*[cv] (Precious Mirror of the Preservation of Health) by Lo Thien-I.[cw] Where we find a very clear concentration on prevention rather than cure is in the book *I Hsien*[cx] (Pre-therapeutic Therapy) by Wang Wên-Lu[cy] of the Ming; this was written about +1550.

The Yellow Emperor's Treatise

We now come to the ideas on preventive medicine in the greatest of all the Chinese medical classics, the *Huang Ti Nei Ching, Su Wên*[ac] (The Yellow Emperor's Treatise on Internal Medicine; the Pure Questions and Answers). To this work we have already referred. Its nucleus must date from the –2d century but it cannot be considered a work compiled only by one individual, nor is it from one period. It certainly summarizes the experience of the Chou and Warring States physicians,[35a] but it also contains interpolations from the Later Han and even subsequent times. The attribution of the work to the mythical Yellow Emperor (a favourite Taoist figure) is of relatively little significance since the work forms a compendium of all the practical knowledge of the ancients and an elaboration of the *philosophia perennis* of Chinese medicine. All later writings in this field derive and develop from the *Nei Ching*. It is quite natural that such a compendious treatise should have been made in the Chhin and Han periods, for the institution of the first unified Empire in the Chhin brought about not only a centralization of government but also a standardization of weights and measures, even down to the gauge of carriage-wheels; in sum, a general orderly systematization of all Chinese practices.[36]

The *Nei Ching* undoubtedly contains the fundamental principles of traditional Chinese medicine. In the *Su Wên* it recognises

[35a] Some gleanings from the Chou texts themselves on medicine and hygiene have been assembled by Shu Shih-Chhêng.

[36] On the *Nei Ching* and its history, we will only mention here out of a large literature the papers by Huang Man and Vogralik.

and describes many specific disease entities, noting the regular association of different symptoms which permit their diagnosis; it traces their aetiology in terms of the classical physiological theories which it itself enunciates, having due regard to external influences; and as for therapeutics it concerns itself chiefly with acupuncture. Unfortunately, although the basic principles of the *Nei Ching* are not difficult, the language of it is archaic and hard to understand. Nor were the ancient commentaries very easy to understand either. Hence during the centuries, only scholars of high quality could master it and become truly learned physicians. Such physicians were termed *tai fu*[cz] or *liang i*,[da] in contrast to which one finds many other terms for itinerant practitioners such as *yung i*[db] or *ling i*[dc] (meaning those who went about with a little bell seeking for patients) or even *chhuan i*[dd] (a term referring, no doubt, to the herbs which they carried strung together on strings as part of their paraphernalia). The difficulty of the *Nei Ching* is that the technical terms are often ordinary words with special meanings and sometimes occur along with the same word used in its ordinary sense in the same passage. Much misunderstanding of Chinese medicine has probably arisen owing to misunderstanding of the *Nei Ching*.

Now throughout the work emphasis is laid on the responsibility of the physician not only to attend to the sick but to maintain the health of the healthy person. At the very opening of the book, we find the statement[37] "Regimen being adopted and the mind and emotions being guarded, how could diseases arise at all? (*Ching shen nei shou, ping an tshung lai*[de])." The philosophy of the *Nei Ching* is, of course, "pneumatic" and the term *chen chhi*[df] (literally, true pneuma) means primarily the innate constitution or endowment of the mind-body organism at birth. Synonyms for this often found are *yuan chhi*[dg] (original pneuma) or *ching chhi*[di] (essential pneuma). The expression *chen chhi*,[df] however, has a wider connotation because it may be regarded also as a health *chhi*[h] or salutary *chhi*[h] if the individual meets with optimum nutritional and other conditions of life, in other words, a *chêng chhi*[dj] (rightly adjusted pneuma). In this case, the four seasons (*ssu chi*[dk]) act upon the body at the right time and to the right extent; their influence is thus rightly adjusted (*chêng fêng*[dl]). On the other hand, if influences adverse to health are met with, unseasonable or harmful "winds" (*hsü*

37 Ch. 1, p. 3a.

fêng,[dm] *hsü hsieh*,[dn] *tsei fêng*[do]),[38] then the *chen chhi*[df] will not be able to reach its fullest expansion and completion. All these unwholesome or unseasonable influences are characterized by the term *hsieh chhi*,[dp] "bane breath" or "crooked pneuma." We may find a good statement of this conception in another part of the *Nei Ching*, the *Huang Ti Nei Ching, Ling Shu*[dq] (The Yellow Emperor's Treatise on Internal Medicine; the Spiritual Motive Force) a text about which there has been great difference of opinion as to dating, but which we regard as Han or possibly Later Han. Here we find[39] the statement that "the *chen chhi*[df] is an inborn nature received from Heaven, and the body in which it exists is fortified by the pneuma of food (literally, the cereal pneuma, *ku chhi*[dr])." Thus we see that the *chen chhi*[df] is a composite term made up of the inborn constitution and the resistance built up by the nutritional regimen and regularity of life which the individual follows or encounters.

These two conceptions were sometimes referred to by the expressions *hsien thien*[ds] (prior to Heaven) and *hou thien*[dt] (posterior to Heaven). These two technical terms are connected with the *I Ching*[t] (Book of Changes), to which we have already referred, where they have to do with two celebrated arrangements of the hexagrams. The *hsien thien*[ds] and *hou thien*[dt] arrangements may be pre-Han but they are certainly associated primarily with two famous mutationist diviners of that dynasty, Chiao Kan[du] and Ching Fang[dv] in the —1st century. These terms occur in many passages in the *Nei Ching*.[40] Thus "prior to Heaven" factors are those of innate constitution plus the effects of adequate nutrition and living conditions, while the "posterior to Heaven" factors are those of specific external influences which act harmfully or beneficially upon the organism.

The second chapter of the *Huang Ti Nei Ching, Su Wên*[ac] is entitled "The Importance of Adjusting the Mind (and Body) to the Climatic Conditions of the Four (Seasons) (*ssu chhi thiao shen ta lun*,[dw] i.e., modernised, *ssu-chi chhi-hou thiao-ho ching-shen ta lun*[dx])." It gives accounts of the results of failure to observe this vital adjustment and says, for instance, that diseases of the *nio*[ca] (or *yao*) class will result in the autumn if it has not been achieved in the summer. The leading idea is that the right

[38] Or of course the poisons of animate or inanimate things.

[39] Ch. 75, p. 13b.

[40] For example, Ch. 69, p. 2a; ch. 70, p. 34a. Further details of the mutationist use of them will be found in connection with the ancient history of the magnetic compass and the compass points in Needham, vol. 4, pt. 1, p. 296.

regimen in the appropriate season prevents the occurrence of diseases in the following season. The term *nio*[ea] is that which later on became standardized for fevers of the malarial type, but it is unlikely that we may take it in such a specialised sense at this early date. Reference is made to chronic diseases (*chiu nio*[eb]), daily fevers (*jih nio*[ec]), intestinal diseases (*sun hsieh*[ed]), and weakness or bad circulation in the extremities (*wei chüeh*[ee]).

HYGIENE, MENTAL AND PHYSICAL

It is remarkable to see how far what we should now call the psychosomatic causation of disease was empirically recognized in ancient China. The philosophers of all the schools agreed without hesitation on the necessity of the cultivation of the mind and the control of the emotions. A typical statement may be found in the book *Shen Chien*[ef] (Precepts Presented to the Emperor) written about +190 by Hsün Yüeh.[eg] There he says:[41] "In order to nourish the spirit, pleasure, anger, pity, happiness, cares and anxieties must at all costs be moderated." He goes on to say that those who are good at controlling their *shen chhi*[eh] (their mental pneuma) can direct it as Yü[ei] the Great (the legendary hydraulic engineer and emperor) did with water, the importance of regulation being to avoid excess and deficiency. The same attitude appears in the *Lü Shih Chhun Chhiu*[ej] (Master Lü's Spring and Autumn Annals), that wonderful compendium of natural philosophy compiled by the proto-scientists and magicians gathered under the auspices of Lü Pu-Wei[ek] around −240 in the State of Chhin.[el] In this book we find the statement:[42]

> Thus for the nourishment of health, nothing exceeds in importance the recognition of the fundamental nature of the human being (*mo jo chih pên*[em]). If this is once understood, then there is no room left for diseases to enter in.

The chapter ends with a splendid passage:

> Nowadays people are always appealing to divination and offering up prayers for health and recovery, yet diseases rampage all the more. It is like an archer at a shooting-match who failing to hit the target calls for another one to replace it—how will this help him to score a bull's-eye? If one wants a kettle of soup to stop boiling, one must take away the fire from underneath. As for all these leeches and physicians, with their drugs and potions

41 Ch. 3, p. 2b.

42 Ch. 12, (vol. 1, p. 25). The writer has just been saying that harm to health arises from excess in any one of the five flavoured foods, or in any one of the five emotions, or in any one of the seven climatic conditions. Cf. the passage in Wilhelm, p. 30.

supposed to expel diseases, to slight them and master them, the wise men of old esteemed such men but little, considering that they dealt with the branch and not with the root.

Here we may need to ask what was meant by the "fundamental nature of the human being." The immediate answer of the philosophers, which was common to most of the schools but especially characteristic of the Confucians, was that the fundamental nature of man is goodness. In this case one immediately sees that the interpretation suggested by the *Lü Shih Chhun Chhiu*[cj] writer has the implication of trusting people and not being suspicious of them, in other words, a healthy well-balanced mental state of social optimism. On the other hand, the medical writers such as those who compiled the *Nei Ching*, for example, would undoubtedly have meant by the fundamental nature of the human being the correct balance (like a krasis κρᾶσις) between the Yin[b] and the Yang.[a] Failure to achieve this adjustment arises from going against (*ni chih*[en]) the seasonally correct mode of life. Here we meet with the philosophically important word *ni*, which throughout ancient Chinese thought refers to all actions or influences going against the true natural patterns into which the whole universe of man and non-human nature spontaneously tends to organise itself. Thus we can see by these examples that, so far as the philosophers were concerned, it was essential to foster a serenity and calmness of mind not merely as an ataraxia (ἀταραξία), an impassibility untouched by the misfortune of others, but a calm assurance based on belief in the fundamental goodness of human beings and the perfectibility of human society.

Turning now to the medical writers, let us see what the *Huang Ti Nei Ching, Su Wên*[ac] says. Right at the beginning of the book we come across the following passage:[43] "When one feels naturally happy and free from self-seeking and upsetting personal desires or greedy ambitions, then the salutary *chhi*[h] of necessity responds and follows (*thien tan wu hsü, chen chhi tshung chih*[co]). Vitality thus guarding from within, how can diseases originate?" Another passage puts very explicitly the effect of mental health upon the actual resistance of the body to external attack. The text says:[44]

Pneuma (literally, wind, *fêng*[i]) is the beginning of all diseases. If there is purity and calm in the mind, then the flesh and the interstitial tissues bar the doors and resist entry (*chhing ching, tsê jou tshou pi chü*[cp]). Then

43 Ch. 1, p. 3a.
44 Ch. 3, p. 16b.

though powerful winds and virulent poisons may be at work, they are quite unable to do any harm.

The balance of the mind being thus safeguarded, the Taoists and the physicians advocated a number of different kinds of comparatively mild gymnastics. These exercises were generally called *tao yin*,[eq] that is to say, extending and contracting the body. In later times, the terms *kung fu*[er] and *nei kung*,[es] implying work, or inwardly directed work, were used for it. Possibly the exercises derived from the dances of the ancient rain-bringing shamans, but in any case they were certainly associated with the idea, as old in Chinese as in Greek medicine, that the pores of the body were liable to become obstructed, thus causing stasis (*yu*[et]) and disease.

Already in the *Lü Shih Chhun Chhiu*[45] we can find the aphorism that "Running water does not become stale nor does a door-pivot ever get worm-eaten" (*liu shui pu fu, hou pu lou*[eu]). This was the basic idea of the gymnastic exercises, the origin of which we see quite clearly in the biography of Hua Tho[ev] in the *San Kuo Chih*[ew] (Official History of the Three Kingdoms). Hua Tho[ev] was an outstanding physician and surgeon (fl. +190 to +265) about whose name many legends subsequently gathered. In his biography in the dynastic history, we read the following interesting passage:[46]

Wu Phu[ex] of Kuang-ling[ey] and Fan A[ez] of Phêng-chhêng[fa] were both pupils of Hua Tho.[ev] Wu Phu[ex] followed exactly the arts of Hua so that his patients generally got well. Hua Tho[ev] taught him that the body should be exercised in every part but that this should not be over-done in any way. "Exercise," he said, "brings about good digestion (literally, causes the dispersion of the cereal pneuma, *ku chhi tê hsiao*[fc]) and a free flow of the blood (*hsüeh mo liu thung*[fd]). It is like a door-pivot never rotting. Therefore the ancient sages engaged themselves in *tao yin*[eq] exercises (for example) by moving the head in the manner of a bear and looking back without turning the neck. By stretching at the waist and moving the different joints to left and right one can make it difficult for people (to grow) old. I have a method," said Hua Tho,[ev] "known as the 'play of the five animals (*wu chhin chih hsi*[fe])' the tiger, the deer, the bear, the ape and the bird. It can be used to get rid of diseases and is beneficial for all stiffness of the joints or ankles. When the body feels ill, one should do one of these exercises. After perspiring, one will sense the body grow light and the stomach will manifest hunger." Wu Phu[ex] followed this advice himself and attained an age greater than 90 yet with excellent hearing, vision and teeth.

45 Ch. 12 (vol. 1, p. 25).
46 *Wei Chih*,[fb] ch. 29, pp. 6a ff.

These techniques generated a rather large literature. One may mention the *Thai-Chhing Tao Yin Yang Sêng Ching*[ff] (Manual of Nourishing the Life by Gymnastics), the date of which is uncertain but perhaps Sung,[47] and secondly, the *Tsun Sêng Pa Chien*[fg] (Eight Explanations on Putting Oneself in Accord with the Life Force) by Kao Lien[fh] of +1591. This latter book was analysed in great detail by Dudgeon who also describes some of the minor works on this subject. Probably the art of Chinese boxing, *chhuan po*,[fi] a technique with quite different rules from that of the West and embodying a considerable element of ritual dance originated from Taoist medical gymnastics. Although we cannot here pursue the matter further,[48] there is considerable reason to believe that the growth of medical gymnastics in modern Europe was influenced by information about the Chinese practices. This influence was marked from the eighteenth century onwards, but of course, there were earlier works in Europe deriving, presumably, from Greek sources. The whole story of the origins of modern hygienic and remedial exercises remains to be written.

Principles of Nutritional Regimen

The importance of a complete and balanced diet was fully recognized in the medical classics of the Han. For example, the *Huang Ti Nei Ching, Su Wên*[ac] says:[49]

> Taking the five cereals as nutriment, the five fruits as assistants, the five meats as chief benefactors, and the five vegetables as supplements, and combining together the *chhi*[h] and the tastes (*wei*[fk]) in the diet; this blending is what benefits the mind and body.

Elsewhere the same work says:[50] "When eating and drinking is doubled the stomach and intestines are seriously harmed." And again we read of a certain disease:[51] "The origin of this is the patient's abnormal way of food intake and mode of life." On nutrition in general the text says:[52] "Eat moderately, live with regularity, never get too tired either physically or mentally. In this way good health is guarded from within. How could diseases arise?"

In later times the tradition of dietary medicine developed and expanded very fully. For example, in the Sung period (*ca.*

47 No. 811 in Wieger's *Tao Tsang*[fl] catalogue.
48 cf. Needham, vol. 2, pp. 145 ff.
49 Ch. 22, p. 10a, b.
50 Ch. 43, p. 10b.
51 Ch. 43, p. 8a.
52 Ch. 1, p. 2a.

+1080), Chhen Chih[fl] said that old people are generally averse to taking medicine but are fond of food.[53] It is therefore far better to treat their complaint with proper food than with drugs. Nutritional therapy should be resorted to first and drugs prescribed only after proper feeding has failed. This he considers the great rule in caring for the aged. "Experts at curing diseases (*chih chi*[fn])," he said, "are inferior to specialists who warn against diseases (*shen chi*[fo]). Experts in the use of medicines are inferior to those who recommend proper diet." In the same work, Tsou Hsüan[fp] (about +1307) wrote that:[54]

> physicians must first recognize the causes of an illness and know what transgression of the normal regular (balance of the Yin[b] and Yang[a]) has taken place. To correct this imbalance, adequate diet is the first necessity. Only when this has failed should drugs be prescribed.

In the Thang also, the works of physicians such as Sun Ssu-Mo[au] contain many forms of nutritional treatment.

How large the nutritional literature was in the Chinese Middle Ages may be gauged from a glance at the titles of some of the more important of the lost books. *Shih Ching*[fq] (Nutrition Manuals), or what Shih Shêng-Han calls "Catering Guides," appear as early as the San Kuo period (+3d century) with the *Shih Liu Chhi Ching*[fr] (Manual of the Ingestion of the Six Chhi), a very Taoist book. The context in the bibliography[55] shows that this work probably had to do partly with quasi-magical heliotherapy and similar techniques of union with Nature, but it would also have included principles of dietary regimen, e.g. how to deal with the cereal pneumata (*ku chhi*[dr]). Of regular practical treatises on diet there was no lack, however. The *Sui Shu*[fu] (History of the Sui Dynasty) bibliography, compiled by +635, lists no less than nine *Shih Ching*,[fq] one of the most famous being by Tshui Shih,[fv] the mother of Tshui Hao,[fw] one of the ministers of the Northern Wei Dynasty who died in +450. The Thang bibliographies list several more, and by the Sung we hear of a *Shih Chhin Ching*[fx] (Manual of Forbidden (or Dangerous) Foods) by Kao Shen,[fy] and a *Shih I Hsin Chien*[fz] (Essential Mirror of Nutritional Medicine) by Tsan Yin.[ga] Among the "pharmacopoeias," several concerned themselves specifically with foods, notably the *Shih Liao Pên Tshao*[gb] by Mêng Shen[gc] in the Thang

53 *Shou Chhin Yang Lao Hsin Shu*[fm] (On the treatment of the aged), ch. 1, p. 22a (sect. 13).

54 Ch. 2, p. 21a.

55 *San Kuo I Wên Chih*,[fs] p. 108; in *Erh-Shih-wu Shih Pu Chu*,[ft] vol. 3, p. 3296.3.

(+670) and the *Shih Hsing Pên Tshao*[gd] by Chhen Shih-Liange[ge] in the Sung (+10th century). Some of these are still extant.

Here space is lacking to enlarge upon the empirical discovery of vitamins through the study of deficiency diseases in mediaeval China. This has already been the subject of a paper,[56] and we hope to return to it in much greater detail elsewhere. The greatest name in this field is no doubt that of Hu Ssu-Hui,[gf] Imperial Dietician between +1315 and +1330. His book, the *Yin Shan Chêng Yao*[gg] (Principles of Correct Diet), finished in the latter year, describes in much detail the wet and the dry forms of beri-beri and advocates foods now known to be rich in vitamins for the treatment of those suffering from deficiency diseases. The empirical recognition of these is summarised in Hu's aphorism "many diseases can be cured by diet alone (*shih liao chu ping*[gh])."

Water and Tea

The importance of supplies of pure drinking water was appreciated very early amongst the Chinese. Already in one of the most ancient texts, the *I Ching*[t] (Book of Changes) which we might date somewhere about the −7th century, we find the commonplace "Men do not drink water from foul wells."[57] The *Shih Ming*[gi] dictionary (+100) says,[58] punning, "A well (*ching*[gj]) means essentially clear and clean (*chhing*[gk]), the clear produce of a spring." Regular custom in ancient China demanded the periodic cleaning of wells. For example, in the *Kuan Tzu*[gl] book dating from about the −4th century, we have two passages on this; the first says:[59]

> In the third month (of the year) they *chhiu*[gm] dwellings and dry out (*than*[gn]) new houses. [The commentary says:] *Than*[gn] means to dry with fire. In the third month the Yang *chhi*[h] is expanding, so that pestilences easily arise; (therefore it is necessary to) fumigate dwellings with *chhiu*[gm] wood[60] which takes away bad smells and removes poisonous vapours (*tu chhi*[go]). The same wood is burned to dry out new houses, and this forms part of the purification ceremony. [The text continues] At this time, new fire is obtained by the use of the wood drill and the burning mirror, and new water is got by thoroughly cleaning out (lit. shuttling, *chu*[gp]) the wells. All this brings about the expulsion of poisonous influences harboured from the past.

56 Lu and Needham.
57 Baynes tr., vol. 1, p. 199, the *hsi tzhu*[gr] of the *Kua*[s] Ching.
58 Ch. 17 (Palaces and dwellings).
59 Ch. 53, p. 11b.
60 *Catalpa kaempferi*, Read, no. 99.

The second passage says that among the regular work of spring and summer is the clearing out of wells and the removal of all extraneous matter from them, so that the water becomes more pure to drink. These customs continued right through the Han period. In the *Hou Han Shu*[gq] (History of the Later Han Dynasty) we find[61] that the summer solstice (June) was then considered the right time for "changing the water", i.e., digging new wells and cleaning out the old ones. At this time of the year there was a prohibition against making big fires and melting or casting metals which lasted until August. This cleaning out of wells in the summer was again analogised with the obtaining of new fire by boring of wood or the use of a burning-mirror at other times of the year, especially the winter solstice.

In the +11th century, Shen Kua,[gs] the famous scientific scholar, writing in his *Wang Huai Lu*[gt] (What Not to Forget to Take with You when Preparing for a Journey)[62] describes to us the care taken even at that time for the preservation of purity of water sources. He says: "Covers are made for wells, and people lock them up to prevent insects (worms, reptiles, etc.) and rats from falling into them, not to speak of people's children." In connection with wells, Shen Kua[gs] says in the same book that people were fond of "medicated wells" (*yao ching*[gu]). These were something like what we should call today "sand filters." He says that in the mountains there is quartz, magnetite, and mica as well as stalactites in caves, and these materials were pounded into chips not too fine and filled into the wells for several feet. Some, following lines of thought derived from alchemy, put down cinnabar and sulphur and chipped jade. In the Thang period, the family of Li Wên-Shêng[gv] had been famous for having one of these alchemical "medicated" wells. Shen Kua's[gs] contemporary, the poet Su Tung-Pho,[gw] mentions the purification of well water by filtration through sand on the opening page of his *Wu Lei Hsiang Kan Chih*[gx] (On the Mutual Responses of Things according to their Categories). A mention of clearing water or fermented beverages by glue or isinglass occurs[63] in the —2nd century *Huai Nan Wan Pi Shu*.[bm]

The extent of piped water supplies in ancient China has been very much underestimated by most later writers, both Chinese and Western. It is only now with the great expansion of

61 Ch. 15, p. 5a.
62 In *Shuo Fu*,[gy] ch. 19, p. 14b.
63 Entry no. 84. Cit. in *Thai-Phing Yü Lan*,[bs] ch. 736, p. 8a.

archaeological investigation and excavation in China that evidences of this are coming to light. Throughout the Chhin and Han periods, palaces and cities were supplied with piped water not only in bamboo tubing, very easily installed and replaced, but also by conduits of earthenware. In Chinese museums at the present time, abundant examples of these water supply pipes can be found. There are large earthenware rings about three feet across for lining the walls of wells, and a great quantity of piped lengths usually about two feet long, sometimes with right angles or two-way divisions, and usually with flanges for fitting the lengths of piping together. Fuller particulars of these we expect to give shortly elsewhere.[64] Such facts lend particular interest to one of the oldest accounts of water-raising machinery which we have. It concerns the Han Dynasty engineer Pi Lan[gz] who in +186 was entrusted with the water supplies of the capital city of Loyang. The following passage comes from the biography of Chang Jang[ha] in the *Hou Han Shu*[gq]:[65]

> Pi Lan[gz] was commissioned to make (lit. cast) norias (*thien lu hsia ma*[hb]) (which would) spout forth water. These were set up to the east of the bridge outside the Phing Mên[hc] (Peace Gate) where they revolved (continually, sending) water up to the palaces. He also made square-pallet chain-pumps (*fan chhê*[hd]) and "siphons" (*kho wu*,[he] possibly lift-pumps) which were set up to the west of the bridge (outside the same gate) to spray (*sa*[hf]) water along the north-south roads of the city, thus saving the expense incurred by the common people (in sprinkling water on these roads, or carrying water to the people living along them).

This passage is one of the first in Chinese literature which clearly describes the norias and the chain-pumps so characteristic of later Chinese technology. The identification of the latter is certain and that of the norias (wheels driven by the force of the current and having bamboo containers attached to their periphery thus lifting the water to a flume high above the river level) is almost so.

A rather astonishing statement is found in the writings of Chuang Chho[hg] (fl. ca. +1126), for he says: "Even when the common people are travelling they take care only to drink boiled water." We have not yet been able to locate the exact source of this statement which is quoted by Fan Hsing-Chun but seems not to be in any of the books of Chuang Chho[hg] available to us; yet there is nothing in the least improbable about it since the

64 See Needham, vol. 4, pt. 2.
65 Ch. 108, p. 24b.

practice of drinking tea and consequently boiling the water in which it was infused, had already a thousand years of life before the time of Chuang Chho.[hg] In fact, the practice of tea-drinking originated during the Later Han period[66] and references to it begin to become numerous towards the end of the Three Kingdoms period and the Chin, around +270. Originally it was introduced, in all probability, as a drug, and its effect of inducing transient insomnia in certain subjects was very early known. But by the +4th century it had universally conquered Chinese society and was everywhere used as the refreshing drink we know. An interesting story comes from the *Nan Pu Hsin Shu*[hh] of Chhien Hsi-Pai,[hi] a Sung writer. He tells us that:

> In the third year of the Ta-Chung reign-period (+849), Tung Tu[hj] presented to the Emperor an old monk more than 120 years of age. Hsüan Tsung,[hk] the emperor, asked him, "What medicines did you take in order to attain this longevity?" He replied, "Your servant was born in a poor family and never attained to any understanding of the nature of medicines. But I have always been extremely fond of drinking tea. Wherever I go I look for it and when I visit another temple I often drink more than 100 cups in one day. Even normally I drink between 40 and 50." Whereupon the Emperor bestowed upon him 50 catties of the best tea and prepared a lodging for him to live in the Pao Shou[hl] Temple.

Such was the virtue attributed to the "cup that cheers but not inebriates."

Cooking and Nutritional Hygiene

One of the most important early developments in hygiene is the recognition of the spoilage of food. Food prohibitions played a prominent part in ancient Chinese life, if not perhaps so extensively developed as in ancient Israel. About −500, we meet with a relevant passage in the *Lun Yü*[hm] (Confucian Analects), that celebrated book which gives the sayings of the greatest of all Chinese philosophers, Khung Chhiu[hn] (Confucius) and reminiscences of him by his disciples. Here we are told that:[67]

> Rice which has been injured by heat or damp and turned sour (*i erh ai*[ho]), one must not eat, nor fish or flesh which has spoiled. That which is discoloured or smells badly one must not eat, nor any food which has been insufficiently cooked (*shih jen*[hp]) or which has been kept too long.

66 See the recent studies of Bodde and of Goodrich and Wilbur.

67 X, viii, 1-4, cf. also 8. Legge tr., p. 96, Waley tr., p. 148. This chapter used to be regarded as referring only to the behaviour of Confucius himself, but it is now considered to be a ritual text concerned with the rules for *chün tzu*[a] (educated men) in general, and here particularly with the consumption of sacrificial food. It was probably incorporated in the *Analects* in the Warring States or Chhin and Han periods.

Safety regulations about food are found in very greatly enlarged form in the late +2d century work[68] of the eminent physician, Chang Chung-Ching.[ag] He tells us that eating and drinking is for the enjoyment of taste and the nourishment of life. Yet if it is not correctly ordered, what is eaten can be very harmful. There are certain things which must be abstained from. Only if the selection of diet is wise will the body benefit by it, and if the selection is unwise, great dangers, illnesses very difficult to cure, may arise. Then Chang Chung-Ching[ag] gives long lists of what should not be eaten. Among numerous taboos, the sense of which is not obvious to us today, we find many important prohibitions; for example, all meat and fish which dogs or birds will not eat, or again meat which has on it red or coloured spots; dirty rice, or meat and fish which has a disagreeable smell. Chang also warns against all animals which have died spontaneously, and says that raw meat or milk will turn to white or red parasites (*pai chhung*,[hq] *hsüeh chhung*[hr]). Elsewhere he gives a number of antidotes for poisoning by mushrooms, and cautions against certain toxic wild yams. All this is contained in the book which he entitled *Chin Kuei Yao Lüeh*[ae] (Systematic Treasury of Medicine) and his relevant chapters deserve much more study than they have so far received.

It should be recognized that no people have paid more attention to the importance of cooking than the Chinese. We do not refer here to the gastronomic triumphs of Chinese cuisine which are well known to all the world, but rather to the principles of Chinese cooking whereby so much oil at high temperature was used, the frying being carried on typically in large thin-walled cast-iron vessels (*kua*[hs]). It seems likely that the disinclination for cold food which seems to have characterized Chinese cooking for twenty centuries was a powerful hygienic factor in preventing the spread of infections. Even under the relatively unhygienic conditions of the old China, those Westerners who knew the country realised that the method of preparing food was extremely hygienic, so that as long as one always ate hot dishes the risk of infection was slight. The recognition of the importance of cooking may be illustrated by a statement from one of the apocryphal treatises of the early Han period. In the *Li Wei Han Wên Chia*[ht] (Apocryphal Treatise on the (Record of) Rites; Excellences of Cherished Literature), we read "It was Sui Jen[hu]

[68] See especially *Chin Kuei Yao Lüeh*,[ae] chs. 24, 25. (pp. 89 ff., 95, 96, etc.)

who first drilled wood to obtain fire and taught the people to cook food from raw materials, in order that they might suffer no diseases of the stomach and to raise them above the level of the beasts." Here the reference is to a purely legendary character, a culture-hero, but the recognition of the hygienic function of cooking is quite clear. It was from these roots that there came forth the proverbial saying, "Anything thoroughly boiled or cooked cannot be poisonous, (*pai fei wu tu*[hv])."

Closely allied to the recognition of the role of heat went the mistrust of the presence of insects or other small animals. For example, about +83, Wang Chhung[hw] says in his *Lun Hêng*[hx] (Discourses Weighed in the Balance),[69] "If insects (or worms) fall into the vessel when wine is being made, reject the lot; if rats have run over rice baskets, throw it all away and don't eat it". This is much elaborated in the *Chou Hou Pei Chi Fang*[hy] (Pocket-book of Medicines for Emergencies) written by the great physician and alchemist, Ko Hung,[hz] about +300. He is talking about the *ho-luan*[ia] group of diseases which include cholera (for which the term is specialized today) and also the dysenteries and diarrhoea. Ko Hung[hz] says:[70]

Ho-luan[ia] diseases arise from food and drink, often because various raw or cold things have been eaten, or greasy food or uncooked fish soaked in wine; or else because of exposure to draughts and dampness, or by sitting in the wet fields with insufficient clothing, or by having inadequate bedding at night.

Here we see the suspicions aroused by uncooked food and possible traces left on it by animals. In the work of the Thang scholar, Wang Thao,[ib] who completed in +752 his *Wai Thai Pi Yao*[ic] (Important Family Practice of a Frontier Official), we find this very explicit. He is talking about *lou*[id] diseases; the term *lou*[id] alone meant originally swollen glands and it covered a considerable number of affections which it is a little hard to be precise about now. But he says:[71]

Lou[id] diseases come from eating and drinking foods which have been contaminated by the essential *chhi*[ih] (*ching chhi*[ie]) of rats, snakes, bees (or flies?), toads, worms and all such kind of vermin; their poisons entering the

69 Ch. 5, p. 1b.

70 Ch. 12, p. 1a (ch. 2, p. 27). Chhao Yuan-Fang[if] quotes Ko Hung[hz] on this, emphasizing again the dangers of raw flesh and cold uncooked food, *Chu Ping Yuan Hou Lun*,[ig] ch. 22, pp. 1a ff.

71 Ch. 23, p. 11b (p. 641). One of the most ancient prescriptions for *lou* disease caused by rats must be that in the *Huai Nan Wan Pi Shu*[bm] of the −2d century (entry no. 67). From the *Wai Thai Pi Yao*[ic] and other texts it is clear that the forms of swellings produced were often supposed to be similar to those of the animals which were thought to have given rise to the diseases.

body cause changes which lead to these diseases. When the local lesions break down, the poisons creep into the blood system and may kill people. Rats and ants are the most noxious for they come more into contact with human beings.

Wang Thao[ib] quotes the *Chou Hou Pei Chi Fang*[hy] of his predecessor Ko Hung,[hz] but in that book's discussion of lou[id] diseases only cures are given[72] and there is no discussion of the infections produced by the action of these animals. In the century before Wang Thao,[ib] Chhao Yuan-Fang[if] had written his magnificent systematic pathology, the *Chu Ping Yuan Hou Lun*[ig] (Systematic Treatise on Diseases and Their Aetiology). Under the heading *lou*[id] he again mentions[73] a great many insects and says that one *lou*[id] comes from eating fruit or melons contaminated by them. In this connection, he quotes a *Yang Sêng Fang*[ih] (Prescriptions for the Protection of Life) as saying that in the sixth month one should never eat fruit which has dropped on the ground and been left over-night. Furthermore, in winter time one should never eat flesh which has been fouled by dogs or rats. Now in the bibliographies of the dynastic histories, no *Yang Sêng Fang*[ih] is to be found but there was a *Yang Sêng Shu*,[ii] a book on this subject, current in the Three Kingdoms period (+3d century). Perhaps the most probable work to which Chhao Yuan-Fang[if] was referring was the *Yang Sêng Ching*[ij] (Manual of the Preservation of Life) written somewhere about the +5th century by Shangkuan I.[ik]

Personal Hygiene and Sanitation

The desirability of frequent and adequate ablutions is a commonplace in the old Chinese medical texts as no doubt amongst most ancient nations. From the general literature, too, it is possible to collect abundant material for a history of bathing customs in the Chinese culture-area.[74] Such a history would consider baths and washing facilities first in relation to the family, then in monastic establishments and colleges, continuing with the development of public bath-houses and ending by an account of the elaborate and celebrated bathing-pools of the imperial palaces in successive dynasties. A special chapter would also have to be devoted to the hot springs, numerous in China. Here we

72 Ch. 41 (ch. 5, pp. 168 ff).
73 Ch. 34, p. 3a (p. 179).
74 This has been done recently in the learned and interesting paper of Schafer. Some of the same ground is covered in Fan Hsing-Chun, pp. 58 ff.

need only say that the terminology of washing and bathing was already stabilised in the late Chou period, indeed in Confucian times (—6th century).[75] We get a striking impression of the cleanliness which traditional etiquette and ceremonial required of the *chün tzu*[hu] (patrician, gentleman, or scholar)[76] of the Warring States period and the Han, from the *Li Chi*[il] (Record of Rites),[77] a compilation completed by —50 though dating in some parts as far back as *ca.* —450. Washing the hands five times a day, with a hot bath every fifth day and a hair-washing every third day was obligatory. This latter operation was considered especially important since the hair was worn long, and many a story in the classical books depends upon the high social value placed upon this duty. The *Lun Hêng*[hx] (Discourses Weighed in the Balance) of +83 shows us that the scholars of the Han took frequent baths,[78] for Wang Chhung[hw] directs a sceptical attack on the superstition, enshrined in a manual called the *Mu Shu*,[ip] that there were lucky and unlucky days for doing so.[79]

With the growth of Buddhism after the +2d century an emphasis on personal cleanliness originally Indian gave powerful reinforcement to the indigenous prescriptions. Buddhist abbeys (as in India and Ceylon) normally contained a bath-house or a bathing-pool, and its use was by no means restricted to the monks and nuns themselves, though at least in the earlier centuries the age-old Confucian prohibition of the mingling of the sexes in bathing was strictly observed.[80]

75 For a discussion of the terms, see Schafer.

76 Cf. p. 432 above. We do not know so much about the customs of the plebs in ancient times, but there are many indications in the texts (including poetry) that they took full advantage of natural bathing-places in lakes and rivers.

77 See especially chs. 12 (Nei Tsê[lm]), 13 (Yü Tsao[ln]) and 41 (Ju Hsing[lo]); Legge tr., vol. 1, pp. 449 ff; vol. 2, pp. 1 ff., 402 ff.

78 Ch. 70. In the Han and later there was a *lustrum* of five or ten days; at these intervals officials took a day off for "relaxation and hair-washing" (see *Shih Wu Chi Yuan*,[lq] ch. 1, pp. 36, a, b).

79 Chinese literature contained a number of books devoted to bathing and personal hygiene. The bibliography of the *Sui Shu*[lr] (ch. 34, p. 26b) lists a *Mu Yü Shu*[ls] (Treatise on the Bath), which would thus have dated from before the +7th century. Furthermore, an emperor himself did not disdain to write a Manual of Balneology, the *Mu Yü Ching*;[lt] this was the work of Hsiao Kang[lu] who reigned for one year (+550) as Chien Wên Ti[lv] of the Liang dynasty. He was a scholar, poet and philosopher who also wrote commentaries on the Taoist classics, and many other works. The subject of balneotherapy in China has been touched upon by Schafer, but deserves more detailed study. There were certainly parallels for those treatments which in Ceylon have left such remarkable traces behind them as the stone medicinal baths like crusaders' coffins still found on the sites of mediaeval hospitals at Anurādhapura and Mihintale.

80 See e.g. the *Lo-yang Chhieh Lan Chi*[lw] (Description of the Buddhist temples and monasteries at Loyang), *ca.* +530, ch. 4 (p. 78) for a story of the jubilation occasioned by the discovery at Pao Kuang Ssu[lx] of a well and bathing-pool which had been built in Chin times. This was in the north. Broadly speaking, in ancient times and in the early Middle Ages bathing customs tended to be rather more emphasized in the south, with its hotter climate, than in the north.

The Taoists also had bathing customs which figured prominently in connection with their fasts and purification ceremonies before important festivals. This practice had since ancient times been a matter of course for the emperor and high officials before great State liturgies and sacrifices. Bath-houses and bathing-pools were also attached to colleges, as we know from a number of stories concerning (for example) poems written on their walls.[81] Possibly because of a decline in the prosperity of Buddhist foundations after the Thang, the Sung saw the rise and rapid development of public bath-houses. In the Wu Tai period (about +914), the monk Chih-Hui[ix] became famous for the water-raising machinery constructed by him for the public baths at Loyang which accommodated thousands of people.[82] Perhaps these were still Buddhist baths, public but not yet commercial. However, from the +11th century onwards, references to bath-houses which one could enter on payment of a fee become quite frequent. By the time when the Sung capital had been transferred to Hangchow the common name for such public baths was *hsiang shui hang*,[iy] "perfumed water establishments."[83] They advertised their presence by hanging up a water-pot or a kettle as their shop sign.[84] These were the baths so much admired by Marco Polo. In later centuries the public *thermae* became almost as notable a feature of Chinese urban life as of that of ancient Rome, but unfortunately they often no longer contributed to hygiene, for the custom was to use the same water over and over again, heating it in boilers and continuously circulating it by chain-pump to the pool. Possibly for this reason the baths came to be known as *hun thang*,[iz] "chaos halls," from the revolving motion of primitive chaos, but it is more likely that the word *hun* here referred simply to the atmosphere of social promiscuity. Since working people engaged in the dirtiest of occupations, together with pedlars, caravan-drivers, and butchers now all used the baths, access to which was not forbidden to those suffering from contagious or infectious diseases, what had begun as a laudable measure of hygiene prob-

81 See *Kuei Hsin Tsa Chih*,[ix] (Pieh Chi[ix]), ch. 1, p. 15a; a work finished by +1308.

82 See Chu Chhi-Chhien and Liu Tun-Chen, p. 163.

83 As in the descriptions of the city given in *Tu Chhêng Chi Shêng*[iy] (+1235) and *Mêng Liang Lu*[iz] ch. 13, p. 3a (+1275); on which see the article by Moule which includes the reference to the bath-houses.

84 So the mid-+12th century *Nêng Kai Chai Man Lu*,[ja] ch. 1, p. 3a. Wu Tshêng[jb] explains that this custom originated of old from the Chhieh Hu Shih[jc] official ("Hoister of the Water-Pot") mentioned in the *Chou Li*[jd] (ch. 7, p. 27a; ch. 30, Biot tr., vol. 2, p. 201). His duty was to signalize in this way the position of the well or other water-source in an army encampment, and besides this of course he had to look after another sort of water-pot, i.e., the time-keeping clepsydra. Cf. Needham, Wang, and Price, p. 159.

ably sometimes did more harm than good.[85] A feature of the better public baths, especially those built round hot or medicinal springs, was the presence of masseurs (*tsha pei jen*[jh] or *khai pei jen*[ji]), as we know for the +11th century already from the poems[86] of Su Tung-Pho.[gw]

Lastly, we shall pass over the heady history of the bathing-pools of the imperial palaces, about which much is known from the Han onwards.[87] The emperor and his entourage of beauties could certainly be trusted to make use of the best facilities which the age had to offer, and whether it was a matter of casting into the pools red-hot bronze statues to heat the water, or causing fountains and cooling streams to play in pavilions during summer heats, architects, engineers, and other servitors were never lacking to organize whatever was possible. It is more germane to our purpose to ask a question, perhaps more prosaic but certainly of greater scientific interest, as to what soap was used by the emperor and all the other bathers we have been discussing?

Here the point of greatest interest is the rather surprising fact that although the modern world is now in the "detergent age," China was always dependent on detergents rather than on true soaps. We can find very little reference to the making of soaps by saponification of fatty acids with caustic alkali in any period of Chinese history. As is well known, the history of soap-making in the West is also strangely obscure.[88] There is some evidence that oil and alkali were boiled together to make soap in ancient Mesopotamia, especially by the Sumerians of Ur, and the same has been claimed for the ancient Egyptians but apparently with less justification.[89] The Greeks and Romans used mainly oil, together with mechanical detergents, and lacked true

85 A graphic account of the *hun thang*[jz] was given in the Ming by Lang Ying[jk] in his *Chhi Hsiu Lei Kao*,[jl] ch. 16, pp. 12a, b, *ca.* +1530. He tells us that in spite of the decline in hygienic level, poor scholars at any rate still used the public baths, attracted by the warmth and facilities which they could not afford at home. Of course, where flowing water was used, as in the hot springs, whether at Fuchow in Fukien, Anning in Yunnan, or Pei-Wên-Chhüan in Szechuan, conditions always remained good, and one of us (J.N.) has the pleasantest memories of visits to them with friends.

86 Cf. his *Ju Mêng Ling*.[jm]

87 Schafer has dealt well with this subject, and the reader is referred to him. He deals in particular detail with the baths at Lintung near Sian, associated so romantically with the Thang emperor Hsüan Tsung[jn] and Yang Kuei Fei.[jo] We had the pleasure of seeing this still delightful place in the summer of 1958. It would not be without interest to extend the study by comparison with the imperial bathing-pools and gardens of other cultures, e.g. those of Anurādhapura in Ceylon, or the remarkable +5th century royal pleasaunce still conserving its original geometrical lay-out at Sigiriya, also in that country, places which one of us (J.N.) had the good fortune to visit in the spring of 1958.

88 Cf. Sherwood Taylor, pp. 129 ff.

89 Cf. Forbes, in Singer, vol. 1, p. 261.

soap. They employed, however, to some extent, the soap-wort (*Saponaria officinalis*) and the soap-root (*Gypsophylla struthium*), resembling therein, as we shall see, the Chinese. References in later times to the re-invention of soap are quite obscure;[90] some indications point to Gaul and some to the Scythians or Tartars of Western Asia. All one can say is that by the time of Galen (+150), true soap was normally in use and continued to be made thereafter. In mediaeval Europe, it was known (if little used) from at least +800 onwards.

Now in China the dependence on the saponins of plants seems to have been complete from early times onward. There were three chief sources of saponins for use as detergents in personal washing and the laundering of clothes. The oldest was the soap-bean tree (*Gleditschia sinensis*),[91] called *tsao chia*.[jp] Although we have not succeeded in finding any references to this in the classical literature of Chhin and Han, it nevertheless clearly appears in the *Shen Nung Pên Tshao Ching*,[cn] the first of the pharmacopoeias,[92] and we may thus securely date its use in the Han.[93] A special variety of this tree, the *kuei tsao chia*,[jq] was recommended as yielding a saponin especially good for the bathing of the body and the washing of hair. This was introduced in the *Pên Tshao Shih I*,[jr] a pharmacopoeia of the +8th century. The second main source of saponins was the tree *Sapindus mukorossi* which produced the beads used in the rosaries of Buddhist monks (*bodhi* seeds).[94] Its Chinese name was *wu huan tzu*[js] or, on account of its unpleasant smell, *kuei chien chhou*.[jt] For this reason it was not allowed in public bath-houses. This source seems not to have been much used before the +10th century when it is first mentioned in the *Khai-Pao Pên Tshao*[ju] of +970. The third and latest saponin

90 Cf. Sherwood Taylor and Singer, in Singer, vol. 2, p. 355. For the post-Renaissance soap industry, see Gibbs, in Singer, vol. 3, pp. 703 ff.

91 Read, no. 387; Stuart, p. 188. See *Chêng Lei Pên Tshao*[jv] (+1249) ch. 14 (p. 341). Related species which were not effective as sources of detergents were recognized early—thus the *chu ya tsao chia*[jw] (pig's tooth soap-bean) or *Gleditschia japonica* (Stuart, p. 188) was noted as useless by Su Kung[jx] in the *Thang Pên Tshao*,[jy] *ca.* +660. See the whole entry in *Pên Tshao Kang Mu*,[jz] ch. 35B, pp. 4a ff.

92 Mori ed., ch. 3, p. 91.

93 This then must have been the saponin detergent of which we hear in the +5th century when a military governor no doubt more familiar with camps than courts drank the water presented to him together with "washing beans" (*tsao tou*[ka]) by servant-girls in a rich household after returning from the lavatory (*Shih Shuo Hsin Yü*,[kd] ch. 34, p. 44a). His name was Wang Tun[ke] (d. +324). An almost identical story, which must also have involved the same detergent, is told about Lu Chhang[kf] in the Thang before +863, (*Yu-yang Tsa Tsu*,[kg] Suppl. ch. 4, p. 6b). The servant-girls always laugh on these occasions.

94 Read, no. 304; Stuart, p. 395. See *Chêng Lei Pên Tshao*,[jv] ch. 14, p. 350; *Pên Tshao Kang Mu*,[jz] ch. 35B, pp. 14a ff.

source was the soap-pod tree (*Gymnocladus sinensis*),[95] the *fei tsao chia*,[jv] which first appears in the *Pên Tshao Kang Mu*[jw] (The Great Pharmacopoeia) completed by Li Shih-Chen[jx] in +1596. Naturally these vegetable products had other uses, for example as emetics, but their principal employment was as detergents. They were made up into balls with different kinds of flour, mineral powders, and perfumes analogous to cakes of soap. The poisonous action of saponins upon fish was well known in the +11th century, for Su Tung-Pho,[gw] the famous poet, mentions it in his small book of natural philosophy,[96] the *Wu Lei Hsiang Kan Chih*.[gx]

Plant biochemists have long recognized that the saponins were a valuable plant product, especially interesting because of the fact that they have no deleterious effects upon the most delicate textile fabrics.[97] One of us (G.D.L.), remembers how her grandmother objected to the introduction of fat soap in modern China partly because it gave a precipitate in hard water and partly because the old detergents had been so safe in action on fabrics; for example, with the saponins, the whiteness of silk was long conserved. Families used to buy the black beans and make their own aqueous extracts from them, laundering silk first, then cotton things; for toilet purposes, people used the dark, moist, scented balls prepared by the druggists, which gave a very beautiful and comfortable soft lather. Other preparations included honey and various kinds of natural fats, notably the *chu i tzu*,[kh] fat from the omentum of pigs.

A fascinating chapter of the *Wai Thai Pi Yao*[ic] is entirely devoted to washing and cosmetic preparations for personal hygiene under the rubric of *tsao tou*[kc] (bath beans). Wang Thao[ib] begins by quoting from the *Chhien Chin I Fang*[kj] by Sun Ssu-Mo[au] (about +680). Sun Ssu-Mo[au] had said:

> Creams used for face and hands, and preparations for making clothes fragrant, and beans used for washing (and bathing), are things which scholars greatly value; therefore they are important articles. In recent times, some pharmacists have kept the recipes as dear family secrets, children being forbidden to reveal them, and (sometimes) not even handed down from father to son. Yet when the sages discovered anything, they always wanted

95 Read, no. 393; Stuart, p. 198. See *Pên Tshao Kang Mu*,[jw] ch. 35B, pp. 13a, b.

96 P. 25. On this work and the literary tradition to which it belonged, see Ho and Needham.

97 Cf. Haas and Hill, vol. 1, pp. 261 ff. Their detergent power may have been weak in comparison with modern detergents, and comparative estimates would be of some interest.

it to be universally known. How could one hope to conceal such things from all the people and prevent the sagely Tao[q] from spreading? That would be strangely contrary to the ideas of the great men of old.

After this, Wang Thao[ib] proceeds to record about 220 recipes including many kinds of saponin detergent. There are two especially for face washing (*hsi mien fang*[kl]), five for hair washing (*mu thou chhü fêng fang*[km]), and eight for bath soap (*tsao tou fang*[kn]). Not all of these and the other medicated detergents, which have various drugs and perfumes added, contain *Gleditschia* (*tsao chia*[iq]), but those which do not have this have other vegetable products which probably contained saponins in sufficiently active form. Among these may be mentioned *pai chu*[ko] (*Aristolochia recurvilabra* or *Atractylis sinensis,* in both cases the roots),[98] and a powder, *tou mo,*[kp] prepared from soya bean (*Glycine soja*)[99] in which saponins must certainly also have been contained. Among the vehicles for the saponins, besides the omentum fat just mentioned, one finds talc, steatite, root powders, beeswax, and other kinds of fatty materials.[100] Wang Thao[ib] never mentions caustic alkali. However, there is plenty of evidence from all these texts that use was made of sodium carbonate (*chien*[kq]) just as *natron* was used in occidental cultures, especially for laundering clothes.

As is well known, the saponins of plants are mainly of two kinds, those of steroid structure and those of triterpene nature. Both are of course complex condensed-ring hydrocarbons and in the native state are generally bound as glucosides, but all contain that double endowment of hydrophilic and hydrophobic groups without which they could not manifest detergent properties. Monomolecular films being formed between the surface to be washed and the adhering particles of dirt or oil, the latter are lifted off as the surface tension is reduced and so the detergent effect is brought about.[101] A typical steroid saponin is the tigogenin from the plant *Digitalis* and a typical triterpene one is hederagenin.

The modern synthetic detergents are, as is well known, quite different in structure, being very largely sulphonic acid derivatives of long-chain non-cyclic hydrocarbons such as lauric acid or the

98 Read, nos. 585 and 14; Stuart, pp. 49 and 58.

99 Read, no. 388.

100 Among the materials used as vehicles for preparing saponin balls and cosmetic creams, the flour of the common pea (*Pisum sativum, wan tou*[kr] or *pi tou*[ks]: Read, no. 402; Stuart, p. 335) was used, at any rate by the time of Li Shih-Chen[jx] (cf. *Pên Tshao Kang Mu,*[jw] ch. 24, p. 20b). He recommended them for removing the traces of smallpox. But pea flour was certainly not, as has been supposed (Schafer, p. 64) the essential ingredient of "washing-legume," better termed "bath-bean" detergent.

101 Cf. the introductory account of Adam and Stevenson.

hydrocarbons of castor oil. Some of them, however, are purely organic soaps, ammonia replacing the usual alkali metal. Standing in a way intermediate between the sulphonated chains or the true soaps and the classical Chinese saponins of highly complex condensed-ring character is the detergent abietic acid, a very surface-active compound obtained from the depolymerization of pine-resin. This has a hydrophenanthrene system of three rings only and is used today in yellow laundry soaps as well as in paper size, varnishes, and plastics. It thus forms a link between the new detergents and the old saponins.

In one specific department of cleanliness, the care of the teeth, a good deal could be said about Chinese practices. Chhao Yuan-Fang,[if] in his early +7th century treatise, the *Chu Ping Yuan Hou Lun*,[ig] refers to this many times. Quoting the (perhaps +5th century) *Yang Sêng Fang*,[ih] he says: "Early in the morning, gnash (or rub) the teeth and then they will not decay. After eating, always wash out the mouth several times; if this is not done the teeth will go rotten and give much trouble."[102]

The use of the soap-bean *Gleditschia* saponin (*tsao chia*[iq]) as a tooth-powder or tooth-paste is referred to in the *Wei Sêng Chia Pao Fang*,[kt] a Sung book[103] probably of the +11th century, and also[104] in the *Phu Chi Fang*[ku] (Simple Prescriptions for Everyman) of +1410. This almost certainly implies the use of some instrument, a roughened stick if not an actual toothbrush. The history of the tooth brush in China has recently been investigated, and evidence brought forward that tooth brushes made with bristles originated in the Liao dynasty (+937 to +1125).[105] Indian influence, entering China with Buddhism, would undoubtedly have brought the use of a simple stick at a much earlier date, and indeed it is possible to see amongst the fresco paintings at the Thousand-Buddha cave-temples at Mo-kao-khu[106] near Tunhuang in Kansu Province on the border of Central Asia, in a cave which may be dated in the near neighbourhood of +775, a very clear

102 Ch. 29 (p. 156.1). The modern term *sou khou*,[kv] to brush the teeth and rinse out the mouth, is already used in this ancient text.

103 Cited in *Pên Tshao Kang Mu*,[jw] ch. 35B, p. 13b.

104 Cited in *Pên Tshao Kang Mu*,[jw] ch. 35B, p. 8b.

105 See the papers of Chou Tsung Chhi.

106 Usually known in the West as Chhien-fo-tung. We had the pleasure of studying this painting personally during the summer of 1958. It is in cave no. 159. The monk is attended by a servant holding a towel and while brushing his teeth with his right hand holds in his left something at first sight remarkably like a tooth-paste tube, in fact perhaps a syringe. Another similar scene is to be found in cave no. 196 where frescoes are of slightly later date but still Thang.

picture of a monk cleaning his teeth. Others have shown[107] that in the early part of the +13th century, both tooth powder (*sanūn*) and toothbrushes made from a plant called *siwak* (*Salvadora persica*), were in use in the Arabic culture-area, especially Egypt. As a first approximation, it would seem likely that the use of a roughened stick spread outwards from India and that the toothbrush, in the strict sense, may have developed both in China and in the Arabic lands. The study of the subject, however, has only just begun.

Another question which has received too little attention is that of the sanitation of lavatories (*tshê*[kw]), both public and private, in China in different periods.[108] In very ancient times, instruments of bamboo, possibly spatulae (*tshê chhou*,[kx] *tshê pi*,[ky] or *tshê chien*[kz]) may have been used with the assistance of water in cleaning the body after defaecation. At other times and places, it seems that pieces of earthenware or pottery were so used. Undoubtedly one material which found employment in this respect was waste silk rag, but after the invention of paper about +100, with which the name of Tshai Lun[la] is always associated, the spreading of more hygienic habits among the whole body of the people was assisted by the increasing availability of this expendable vegetal tissue. No doubt only the upper class had been able to use silk. The rougher kinds of paper for this purpose were called *tshao chih*.[lb] By the time of the Sui dynasty the use of paper in lavatories was probably universal, as we can see from a passage in the *Yen Shih Chia Hsün*[lc] (Family Oeconomica)[109] written by Yen Chih-Thui[ld] about +590. From early times, there must have been some sort of systematic arrangements for the removal of night-soil from urban agglomerations each morning; and in the +13th century we hear the name they bore, *chhing chiao thou*[le] (the "turners-over of unwanted refuse"). This occurs in the *Mêng Liang Lu*[je] (Dreaming of the Past),[110] a valuable work about Hangchow under the Sung, written in +1275 by Wu Tzu-Mu.[lf] The lavatories of some especially luxurious people came down in song and story; mention may particularly be made of

107 See the papers of Wiedemann.

108 See on this the account of Fan Hsing-Chun, pp. 74 ff.

109 Ch. 5, p. 13b. The passage involves a prohibition of using paper on which characters had been written. It will be remembered that the written or printed word in all its forms carried in traditional China some of the numerous associations of the Logos, and to this day highly ornamental stoves or grates of glazed ceramics exist in temple precincts for destroying written or printed paper in an honourable manner, though they are no longer used.

110 Ch. 13, p. 13a.

those in the home of Shih Chhung,[lg] a famous merchant of great wealth in the Chin period (*ca.* +300).[111] Details were reported in the *Yü Lin*[lh] (Forest of Anecdotes) by Phei Chi.[li] Shih Chhung's[lg] lavatories were very elaborate with wash water provided by women attendants, who assisted the toilet and the ablutions of the guests. One interesting detail is the provision of large boxes of Chinese "dates" (the fruit of the jujube tree)[112] which were perhaps intended to absorb evil odours and keep the place sweet. There are stories of rude army commanders, more used to the field than to the niceties of cultured life, eating these dates under a misapprehension as to their purpose, and causing mirth among the servant-girls thereby.[113]

SPECIFIC DISEASES; RABIES AND SMALLPOX

Although in ancient and mediaeval times it was of course impossible to organize efficiently the defence of the population against specific diseases such as hydrophobia and smallpox, it is nevertheless interesting to see what measures were taken in this respect. The recognition of hydrophobia as a specific disease goes back a long way in Chinese history. Indeed, we find what is perhaps the earliest reference to it in a passage referring to −556. This comes from the *Tso Chuan*[lj] (Commentary on the Spring and Autumn Annals), an annotated record of events in the feudal States. The passage reads as follows:[114]

> In the eleventh month of the seventeenth year of Duke Hsiang,[lk] people (in the capital of Sung[ll] State) were chasing after rabid dogs (*chi kou*[lm]). Some entered into the (house of) Hua Chhen.[ln] People followed them into Hua Chhen's[ln] compound and he was scared so he moved away and took refuge in the capital of Chhen[lo] State.

We are not necessarily to conclude that Hua Chhen's[ln] fright was due to fear of the disease, for the whole context of the story indicates that he had good cause to be afraid of many other things and he probably took this as an omen. Nevertheless, it is a very early reference to the disease, especially interesting because it indicates that an organised effort was being made to get rid of the dangerous animals, so much so that they could not rely on sanctuary even in the private houses and gardens of high officials.

111 See the account in Yang Yuan-Chi, p. 170; and *Shih Shuo Hsin Yü*,[84] ch. 30, p. 33a.

112 *Zizyphus sinensis* or *jujuba*, Read, nos. 292, 293; Stuart, p. 466. If the fruits absorbed ammonia, they would have been of service in earth latrines, but it seems they were often used as nose-stoppers.

113 E.g. in the +5th century, *Shih Shuo Hsin Yü*,[84] ch. 34, p. 44a.

114 Ch. 9, cf. Couvreur tr., vol. 2, p. 330.

By the +3d century, we find it very prominent in Ko Hung's[hz] *Chou Hou Pei Chi Fang*[hy] and other medical works.[115] The treatment was usually the expression of blood from the bitten area and subsequent moxibustion.

In the absence of adequate social organization, the sequestration of rabid dogs was not a practical possibility, so the population was warned at certain times of the year. In the Thang, Sun Ssu-Mo[au] tells us in his *Chhien Chin Yao Fang*[al] that:

> Dogs generally go mad during the late spring and early summer. At this time children, weak women or aged people must be warned to carry sticks for their protection. For those who still cannot avoid being bitten in spite of such preventive measures, nothing wards off the danger better than moxibustion daily for 100 days. If at an early stage the wound begins to heal and it is thought that all is over, nevertheless death may come within a very short time. [And elsewhere] When one is bitten by a rabid dog, the symptoms of the sickness appear on the seventh day. If nothing has happened within three weeks one may escape, but only after 100 days have passed without signs of the disease can one be sure that one is safe.[116]

The story of smallpox is rather different from this because China participated prominently in the pre-history of inoculation, in fact the development of variolation procedures. As is well known, brief descriptions of what was probably smallpox occur in the West in the +6th century.[117] But the definitive description is usually considerd to be that of the great al-Razī early in the +10th.[118] Knowledge of the disease, however, is certainly earlier in China than any of these periods. In his *Wai Thai Pi Yao*[ic] of +725, Wang Thao[ib] gave a very clear description of a smallpox epidemic[119] quoting from a book entitled *Chou Hou Fang*.[lp] The circumstantial information provided enables this epidemic to be dated, in probability, at +497; so the book from which Wang Thao[ib] was quoting is not so much the *Chou Hou Pei Chi Fang*[hy] of Ko Hung[hz] as the enlargement of it written in the+6th century by Thao Hung-Ching.[lq] In any case, the description is an exceptionally clear one.[120] We intend to give the translation of it in another paper.

In later ages, the practice of inoculating the contents of smallpox pustules into the nose (*chung hua*[lr] or *chung tou*[ls]

115 *Chou Hou Pei Chi Fang*,[hy] ch. 7, p. 212.
116 Ch. 25 (p. 453.2).
117 Garrison, p. 125.
118 Major, p. 196.
119 Ch. 3 (p. 119.2).
120 The problem of the dating, to which we shall return elsewhere, is discussed at length by Fan Hsing-Chun, pp. 106 ff., and others.

or *chung miao*[lt] was traditionally ascribed to a Taoist or Buddhist adept from O-mei Shan who successfully treated the family of the Prime Minister, Wang Tan,[lu] in the time of the Sung emperor Chen Tsung[lv] (+997 to +1022). This tradition is reported, for example, in the imperial medical compendium[121] of 1749, the *I Tsung Chin Chien*.[lw] However, if we accept only evidence from contemporary literary sources, we must conclude that the technique originated, or in any case began to be prevalent, in the Ming, perhaps not much before the +16th century. In his *Tou Kho Chin Chhing Fu Chi Chieh*,[lx] Yü Thien-Chhih[ly] says that the Lung-Chhing[lz] reign-period (+1567 to +1572) was the time when it became generally known and used. A particularly clear account exists from +1643 when Yü Chhang[ma] in his *Yü I Tshao*[mb] (Miscellaneous Ideas in Medicine)[122] described his consultations over the inoculation of the sons of Ku Shih-Ming.[mc]

It seems likely that then, at some time during the 17th century, the technique spread from China to the Turkish regions; and it is a well-known story[123] how Lady Mary Wortley Montagu (+1689 to +1762), the wife of the British ambassador at Constantinople, allowed the technique to be used on her own family in 1718. Details of it had already been published in Western memoirs[124] by 1714 and the general introduction of variolation or "engrafting," as it was often called, in the West occurred between that date[125] and about 1721. It is interesting that after the Treaty of Nerchinsk in 1689, a special Russian medical mission was sent to China in order to study the method of inoculation used there, and indeed an English medical man in the Russian service, Thomas Harwin, participated in it.[126] The work of Edward Jenner using cowpox occurred of course much later, towards the end of the 18th century (1796). The time is now ripe for a full investigation of the development of the method in China and we hope to devote another publication to this subject. At present, it certainly seems as if the technique originated in China in the 16th century if not in the 15th, or earlier still. If this is so, it formed a remarkable climax to the many centuries of Chinese effort in preventive medicine which the foregoing pages have attempted to outline.

121 Ch. 60, p. 1a. On the tradition, see further Chhen Pang-Hsien, p. 371.
122 P. 52b.
123 Cf. Halsband.
124 See those of Timoni and Pilarini.
125 Cf. the papers of Blake and of Stearns and Pasti.
126 Cf. Cordier, vol. 3, pp. 273 ff., and the interesting paper of Wu Yün-Jui.

Comparisons and Conclusions

Looking back over what has been said, one is moved to compare the achievements of ancient and mediaeval Chinese thought and practice in the field of hygiene with the high lights of other civilizations in the same field. Most of these are, to be sure, common knowledge, for example in ancient Israel the development of sanitary legislation took the form especially of food prohibitions; and both in Israel and in Islam, great emphasis was laid upon ablutions before prayer, and before and after meals. The Hebrews in ancient times were notable also for their circumcision operation, for their laws on leprosy and for the health-giving Sabbath rest. Ancient India also participated, doubtless moved by the heat of the climate, stressing the need for cleansing the body, and there perhaps came the earliest realization of the value of good care of the teeth. To India also much credit is due for the insistence on the cremation of the dead. Then in the West everyone knows of the sanitary latrines and water-conduits of Minoan Crete, while later the love of the Greeks and Romans for gymnastics in the *palaestra* is part of our own heritage. The drainage systems of Roman cities, for example the Cloaca Maxima at Rome itself, and the public baths there supplied by fourteen noble aqueducts built between the −4th and the +2d century are also known to all the world. In Rome, the *quatuor viri viis purgandis,* the officials charged with street-cleaning and the care of the public latrines, recall the similar officials and workers mentioned in the Chou Li[az] and everywhere found during the Sung period.

Viewing the general attitude of the ancient and mediaeval Chinese physicians and scholars to hygiene and preventive medicine, one gains the general impression that it compares most favourably with what was done in Greek and Roman civilizations. It was certainly much better than anything the mediaeval West could show until the Renaissance.[127] Here we met with an in-

127 All such generalizations are of course very difficult to make. Roman bathing customs persisting in the *hammām* of Islam strongly influenced the crusaders so that bath-houses (in which the sexes were not separated) became very popular in late mediaeval Europe. After this there was a marked backsliding in the 16th and 17th centuries, quite paradoxical in view of the spread of classical humanistic culture, and progress was not resumed until the romantic age in the 18th. In judging the comparative achievement of European and Chinese preventive medicine through the centuries, personal hygiene and bathing customs should probably be treated as an independent variable. Assuredly life in a Buddhist or Taoist abbey of the Thang was far more cleanly than in a Christian one of the same period, and Marco Polo noted a similar superiority at the end of the +13th century, yet in the +14th and +15th there may have been less difference. Not until the last half of the 19th century did Europe draw decisively ahead, and now this brief monopoly of efficient plumbing is rapidly ending.

teresting circumstance which has been noted in a number of other connections. There are many branches of science and technology in which the Chinese of ancient times are found to equal the contribution of the classical Western world, after which Europe falls behind for some dozen centuries until the coming of the Renaissance and the renewal of cultural life and scientific thought in the West. A good parallel may be found in the field of quantitative cartography. While in the West the triumphs of the Greek astronomers and geographers, culminating in the map-making of Ptolemy at Alexandria (+2d century), were forgotten during the Middle Ages and this inheritance only revived again at the Renaissance or after the introduction of the magnetic compass to Europe and the rise of the portolan charts, in China matters took a very different course. There also quantitative map-making began in the +2d century with Chang Hêng[md] but it was continued especially by the great geographer, Phei Hsiu,[me] in the +4th, and the use of a rectangular grid for quantitative cartography persisted throughout the Middle Ages until the coming of the Jesuits in the 17th century and the unifying of geography, East and West. In other words, while in Hellenistic times the Mediterranean world was well advanced, this advantage was all subsequently lost, and in the 10th or 11th century, for instance, the Chinese were far ahead of the Europeans in scientific geography. It seems as if something very similar may turn out to be true of the medical sciences as a whole, and certainly, as we see here, with hygiene and preventive medicine in particular.

Nevertheless, there were certain aphorisms in the preservation of health which find echoes in all the civilizations. When we read the *Regimen Sanitatis Salernitanum,* for example, those precepts on health which were offered to a king of England, seemingly about +1100, by the doctors of the medical school of Salerno in Italy, we seem to be in presence of fundamental ideas which the Chinese physicians would have endorsed as well as those of many other cultures. In Harington's translation:

> The Salerne School doth by these lines impart
> All health to England's King, and doth advise
> From care his head to keep, from wrath his heart,
> Drink not much wine, sup light, and soon arise,
> When meat is gone, long sitting breedeth smart;
> And after-noon still waking keep your eyes.
> When mov'd you find yourself to Nature's needs
> Forbear them not, for that much danger breeds.
> Use three Physicians still, first Doctor Quiet,

Next Doctor Merry-man, and Doctor Diet.
Rise early in the morn, and straight remember,
With water cold to wash your hands and eyes
In gentle fashion reaching every member.
And to refresh your brain whenas you rise
In heat, in cold, in July and December
Both comb your head, and rub your teeth likewise. . . .

We must not quote more but words of this kind remind us that men of intelligence in all the cultures throughout the ancient and mediaeval times would have been at one with Hippocrates and Galen, with Pien Chhio[at] and Chang Chung-Ching[ag] in their advice on health to Everyman.

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CHRONOLOGY OF CHINA

	Hsia kingdom (legendary?)	ca. −2000/ ca.−1500	
	Shang (Yin) kingdom	ca. −1500/ ca.−1030	
Chou dyn. (Feudal Age)	Early Chou period	ca. −1030/ −722	
	Chhun Chhiu period	− 722/ −480	
	Warring States period	− 480/ −221	
First Unification	Chhin dyn.	− 221/ −207	
	Han. dyn. Earlier or Western Han	− 202/ +9	
	Han. dyn. Hsin interregnum	+9/ +23	
	Han. dyn. Later or Eastern Han	+25/ +220	
First Partition	Three Kingdoms Period (San Kuo)	+221/ +265	
	Shu (west)		+221/+264
	Wei (north)		+220/+265
	Wu (southeast)		+222/+277
Second Unification	Chin dyn. : Western	+265/+317	
	Eastern	+317/+420	
	Former (or Liu) Sung dyn.	+420/+479	
	[Northern Wei dyn. (Tho-Pa Tartar) later split into Eastern and Western		+386/+554]
Second Partition	Northern and Southern Empires (Nan Pei Chhao)	+479/+581	
	Chhi (southern)		+479/501
	Liang		+502/+557
	Chhen		+557/+589
	Chhi (Northern)		+550/+581
	Chou (Northern)		+557/+581
Third Unification	Sui dyn.	+581/+618	
	Thang dyn.	+618/+906	
Third Partition	Five Dynasty period (Wu Tai)	+907/+960	
	Later Liang		907/+923
	Later Thang		+923/+936
	Later Chin		+936/+946
	Later Han		+947/+950
	Later Chou		+951/+960
	[Liao dyn. (Chhi-Tan Mongol)	+907/+1125]	
	[Hsi Hsia State		+990/+1227]
Fourth Unification	Northern Sung dyn.	+960/+1126	
Fourth Partition	Southern Sung dyn.	+1127/+1279	
	Chin (Ju-Chen Tartar) dyn.	+1115/+1234	
Fifth Unification	Yuan (Mongol) dyn.	+1260/+1368	
	Ming dyn.	+1368/+1644	
	Chhing (Manchu) dyn.	+1644/+1911	
	Republic	+1912 on	

LIST OF CHINESE CHARACTERS

a	陽	y	聖人不病以其病病是以不病
b	陰	z	淮南子
c	表	aa	劉安
d	里	ab	良醫常治無病之病故無病
e	熱	ac	黃帝內經素問
f	寒	ad	防病重于治病
g	陰陽	ae	金匱要畧
h	氣	af	張機
i	風	ag	張仲景
j	養生	ah	抱朴子
k	道德經	ai	葛洪
l	攝生	aj	三數
m	道生	ak	內篇
n	精神的修養	al	備急千金要方
o	應四時的變化	am	鶡冠子
p	正常規律	an	趙
q	道	ao	卓裘
r	衛生	ap	孝王
s	術	aq	龐煖
t	易經	ar	文
u	君子	as	魏
v	老子	at	扁鵲
w	象傳	au	孫思邈
x	卦	av	熟艾

aw 甘草
ax 桂心
az 周禮
ba 山海經
bb 考工記
bc 齊
bd 醫師
be 食醫
bf 疾 〃
bg 瘍 〃
bh 獸 〃
bi 庶氏
bj 毒蠱
bk 翦氏
bl 莽
bm 淮南萬畢術
bn 莽草
bo 〃 〃 浮魚
bp 赤友氏
bq 蜮氏
br 牡鞠
bs 太平御覽
bt 壺涿氏
bu 蟲
bv 萍氏
bw 蜡氏
bx 野廬氏
by 防 ·
bz 佩之
ca 蠱
cb 眯
cc 服之
cd 食 〃
ce 防蠱
cf 〃 疫
cg 强壯
ch 防五官病
ci 防皮膚外科諸病
cj 〃 臟氣諸病
ck 避孕
cl 防獸病
cm 養生之道
cn 神農本草經
co 莊子
cp 庚桑楚
cq 南榮趎
cr 衛生之經
cs 〃 〃 十全方
ct 夏德懋
cu 莊子補註
cv 衛生寶鑑
cw 羅天益

cx 醫先
cy 王文祿
cz 大夫
da 良醫 〃
db 庸 〃
dc 鈴 〃
dd 串 〃
de 精神内守病安從來
df 真氣
dg 元 〃 〃
di 精 〃 〃
dj 正 〃 〃
dk 四季
dl 正風
dm 虛 〃
dn 〃 邪
do 賊風
dp 邪 〃
dq 黃帝内經靈樞
dr 穀氣
ds 先天
dt 後 〃
du 焦贛
dv 京房
dw 四季調神大論
dx 四季氣候調和精神大論
ea 瘧
eb 久瘧
ec 日 〃
ed 殘泄
ee 痎瘧
ef 申豎
eg 荀悅
eh 神氣
ei 禹
ej 呂氏春秋
ek 呂布韋
el 秦
em 莫若知本
en 逆之
eo 恬憺無虛真氣從之
ep 清靜則肉腠閉拒
eq 導引
er 功夫
es 内功
et 鬱
eu 流水不腐户樞不蠹
ev 華佗
ew 三國志
ex 吳普
ey 廣陵

ez 樂阿
fa 彭城
fb 魏志
fc 穀氣得消
fd 血脉流通
fe 五禽之戲
ff 太清導引養生方
fg 遵身八脫
fh 高濂
fi 拳搏
fj 道藏
fk 味
fl 陳直
fm 壽親養老新書
fn 治疾
fo 慎"
fp 鄒鉉
fq 食經
fr 食六氣經
fs 三國藝文志
ft 二十五史補篇
fu 隋書
fv 崔氏
fw 崔浩
fx 食禁經
fy 高伸
fz 食醫心鑑
ga 咎殷
gb 食療本草
gc 孟詵
gd 食性本草
ge 陳士良
gf 忽思慧
gg 飲膳正要
gh 食療諸病
gi 釋名
gj 井
gk 清
gl 管子
gm 蒜
gn 漢
go 毒氣
gp 杼
gq 後漢書
gr 繫辭
gs 沈括
gt 忘懷錄
gu 藥井

gv 李文勝
gw 蘇東坡
gx 物類相感志
gy 説浮
gz 畢嵐
ha 張譲
hb 天禄蝦蟇
hc 平門
hd 翻車
he 渇烏
hf 灑
hg 莊綽
hh 南部新書
hi 銭希白
hj 東都
hk 宣宗
hl 保壽
hm 論語
hn 孔丘
ho 饘而餬
hp 食飤
hq 白蟲
hr 血 〃
hs 鍋

ht 禮緯含文嘉
hu 燧人
hv 百沸無毒
hw 王充
hx 論衡
hy 肘後備急方
hz 葛宏
ia 霍亂
ib 王燾
ic 外臺秘要
id 螻
ie 精氣
if 巢元方
ig 諸病源候論
ih 養生方
ii 〃 〃書
ij 〃 〃經
ik 上官翼
il 禮記
im 内則
in 玉澡
io 儒行
ip 沐書
iq 事物紀原

ir 沐浴書
is 〃 〃 經
it 簾 綱
iu 簡文帝
iv 洛陽伽藍記
iw 寶光寺
ix 知慧
iy 香水行
iz 癸辛雜識
ja 別集
jb 都城紀勝
jc 夢粱錄
jd 能改齋漫錄
je 吳曾
jf 挈壺氏
jg 混堂
jh 擦背人
ji 搭〃〃
jk 郎瑛
jl 七修類藁
jm 如孟令
jn 玄宗
jo 楊貴妃
jp 皁(皂)莢
jq 鬼皂〃

jr 本草拾遺
js 無患子
jt 鬼見愁
ju 開寶本草
jv 肥皂莢
jw 本草綱目
jx 李時珍
jy 證類本草
jz 猪牙皂莢
ka 蘇恭
kb 唐本草
kc 澡豆
kd 世說新語
ke 王敦
kf 陸暢
kg 西陽雜俎
kh 猪膀子
kj 千金翼方
kl 洗面方
km 沐頭去風方
kn 澡豆方
ko 白朮
kp 豆末
kq 鹼
kr 豌豆

ks 華豆
kt 衛生家寶方
ku 普濟方
kv 澈口
kw 廁 〃
kx 〃 籌
ky 〃 簏
kz 〃 簡
la 蔡倫
lb 草紙
lc 顏氏家訓
ld 〃 之推
le 傾脚頭
lf 吳自牧
lg 石崇
lh 語林
li 裴啟
lj 左傳
lk 襄公
lm 瘈狗
ln 華臣
lp 肘後方
lq 陶弘景
lr 種花
ls 〃 豆 (痘)
lt 種苗
lu 王旦
lv 真宗
lw 醫宗金鑑
lx 痘科金鏡賦集解
ly 俞天池
lz 隆慶
ma 喻昌
mb 寓意草
mc 顧謐明

John Hunter's Animals

JESSIE DOBSON*

INFORMATION about the provenance of the material from which John Hunter prepared the specimens contained in his museum remained undisclosed, for the most part, while his manuscripts continued in the possession of Everard Home; and much was undoubtedly lost as a result of Home's feeling obliged, rightly or wrongly, to destroy so many of these. Furthermore, almost all those which survived remained unpublished for many years. It was not, in fact, until 1861 that Richard Owen edited and published Hunter's *Essays and Observations on Natural History, Anatomy, Physiology, Psychology and Geology*. At that date he had already held for five years the post of Superintendent of the Department of Natural History at the British Museum, having previously been Conservator of the Hunterian Museum at the Royal College of Surgeons since the retirement of his father-in-law, William Clift, in 1842. These *Essays and Observations* contain a wealth of learning and interesting personal detail with which comparatively few are acquainted.

Richard Owen estimated that in John Hunter's collection of 13,682 specimens some five hundred different species were represented; descriptions were left for at least two-thirds of these. It is to Owen that we are indebted for the identification of many of these animals, for some were 'non-descript' and if named at all, bore the native appelation 'Wha-Tapoa Roo' (Australian Opossum), or the popular one, such as 'Man-tiger from Africa' (Mandrill). What were later recognized as varieties of the same species were often given temporary individual names, and frequently external appearance and habit had to be deduced from the verbal accounts of travellers. The eighteenth century was marked for an increased interest in travel which encouraged enthusiasm for possessing examples of the curiosities of natural history. John Hunter, however, aimed not merely at owning a collection but at building a museum designed with inspiration and method. It was to be comprehensive and self-explanatory. For the naturalist it would serve to emphasise the variety and profusion of living things; to the anatomist it would display the complexities as

* Hunterian Museum, Royal College of Surgeons, London.

well as the uniformities of structure; while the physiologist would be able, perhaps for the first time, to see and even to interpret the effects of the interdependence of structure and function. To achieve this ideal it was desirable to collect examples of all known living things and to this end John Hunter directed his energies.

The difficulties in obtaining suitable and typical materials at that time were many but there were three main sources of supply. The first, and in some ways most satisfactory, was the menagerie—of which there were two in London in Hunter's day. One was housed in the Tower and had an interesting history. Even in very early times a rare animal formed a suitable gift from one potentate to another. The earliest English example appears to be the offering of a lion and a leopard to Henry I (1068-1135), youngest son of William the Conqueror. These he kept at the royal residence at Woodstock, for nothing pleased a king more in times of relaxation than to watch his menagerie. The lion was regarded as a particularly appropriate royal pet, was often named after the king, and the length of its life was thought to be closely associated with that of the monarch. When George II died at the age of 77, the great royal lion Pompey, who died in the same year, was reported to have been more than seventy years old, considerably more than the average life span of this animal. In the twelfth century the menagerie at Woodstock was enriched by gifts of hyaenas, porcupines, and several other uncommon beasts. When Henry III succeeded to the throne in 1216, however, he elected to have the collection transferred to the Tower of London, possibly since the security of the animals presented some difficulties; but more likely because he would be justified thereafter in charging the upkeep to the Sheriffs of London. In 1252 these gentlemen was required to provide fourpence a day for the maintenance of the Norwegian White Bear; to provide a muzzle and an iron chain and a long cord to hold it during the time it was fishing in the Thames! Two years later Louis IX of France presented an elephant to the King who issued a writ to the Sheriffs of London directing them to make sufficient provision for the animal ("Elephans noster") and its keeper; and another which ordered them to "build, out of the city revenues, in our Tower of London, one house of forty feet long and twenty deep, for our Elephant." No doubt the people of London began to wish that the gifts to their sovereign would take the form of something a little smaller and less expensive to maintain.

In Hunter's time the royal menagerie seems to have been well supplied with a variety of rare animals, including, in 1787, a black leopard from Bengal as well as two of the ordinary variety. Having become friendly with the keeper of the royal animals, he was able to secure the carcasses of those which died. Among these were two elephants, an ocelot, an antelope, a caracal, and two hyaenas. These last died at the Tower in 1792 after a fight. Part of a letter among the Hunter manuscripts at the Royal College of Surgeons, written from Gibraltar and dated 15 December 1791, relates to them (the writer is unknown):

> He has also on board two young hyaenas, whelped last April and which I have had since they were two days old. You need not be afraid of them; for in spite of what authors say, they are as tame as puppies, having always lived loose in the house, dined at table with the dogs, and usually in my lap or bed. I have put six sheep on board for them as they love raw meat. Their usual allowance here was a bullock's pluck without the liver; and the bones at table.[1]

Hunter describes the caracal as follows: "Is a cat I had from the Tower of a brownish dun, and was something like the shargoss; for it had long hair on the tip of the ears." (Fig. 1). Shargoss is a corruption of a native word meaning 'Black Ears', a name given also to the Ratel. Another animal from the Tower was named by Thomas Bewick 'The Sand Bear' (Fig. 2), but identified by Hunter as a Raccoon, for he wrote: "In a white animal, just the shape of a racoon and indeed I believe only a white one, I found the viscera just like a racoon's."

The other London menagerie was a privately owned concern operated for profit. It was housed in Exeter Change on the north side of the Strand between Wellington Street and Southampton Street. This was originally the site of Cecil House, residence of Lord Burleigh, Chancellor to Queen Elizabeth I. On his death the property passed to his son, the Earl of Exeter, and was renamed after him. This building was demolished in 1676 and Exeter Change was erected—a large building extending into the roadway so that the sidewalk of the Strand passed through it and could be closed at night. On the ground floor were shops, and the upper rooms were let out as offices until 1773 when they were used as a menagerie and place of entertainment managed by a Mr. Polito (Fig. 3). He was the proprietor until well into the next century when Lord Byron was a frequent visitor 'to see

[1] The manuscript is in William Clift's handwriting and is presumably a copy of an original destroyed by Home.

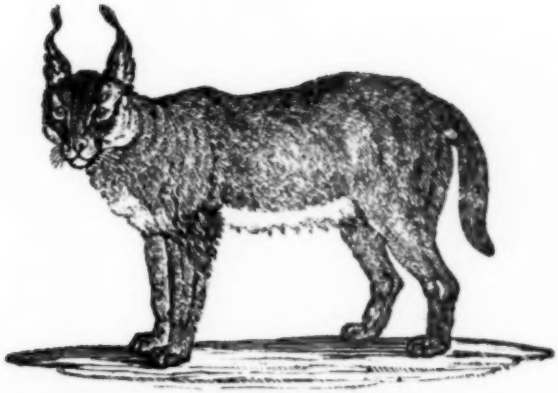
the tigers sup.' He is said to have remarked that the rhinoceros had a face something like Lord Liverpool's, while the Sloth Bear had the voice and manner of his valet (Fig. 4).

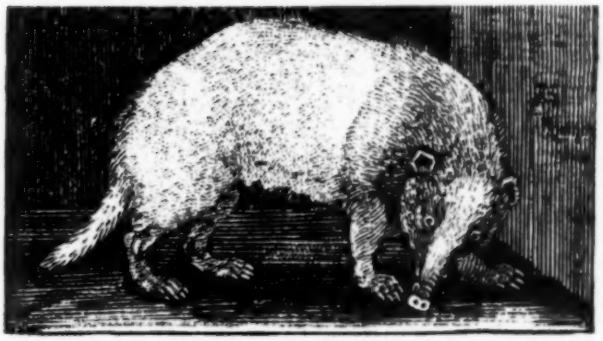
Hunter's second main source of supply was the animal dealer, two of whom he mentions particularly—Mr. Gough, whose animal and bird shop was on Holborn Hill just opposite St. Andrew's Church, and Mr. Bailey who had an establishment in Piccadilly about six doors away from the top of the Haymarket. His shop was taken over by Mr. Brookes (brother of the anatomist, Joshua Brookes) a big, ruffianly-looking man, generally known either from his appearance or his occupation as 'Wild-beast Brookes'. It was at Mr. Brookes's shop that Hunter saw a specimen of the 'Zibet' which is illustrated by Thomas Bewick (Fig. 5) and he remarks that "it is of the civet kind and it seems to be one or perhaps more removes from the cat. In one at Mr. Brookes the anatomy was exactly the same; it had an elliptical pupil with the long axis turned upwards and downwards, similar to that in the cat." It was from Mr. Gough that Hunter obtained the carcass of a large black bear from Patna which had been kept alive in his shop for many years; and he supplied the she-wolf which was mated with Hunter's dog 'Lion.' Hunter made many experiments such as this, the results of which were read before the Royal Society on 26 April 1787 and published in the *Philosophical Transactions* under the title "Observations tending to show that the Wolf, Jackal, and Dog are of the same Species."[2]

On the very morning of Hunter's death, 16 October 1793, Gough had sent a pair of Golden Eagles to Earl's Court which, says William Clift, "were not yet uncaged when I went to countermand them." It was he too who took over all the animals then alive at the house which had to be sold within a short time of the death of the owner. The two subjects of George Stubb's painting "Baboon and Albino Macaque" at the Royal College of Surgeons were obtained from Mr. Bailey and Mr. Gough.

Hunter purchased all rare animals which came his way; and those he acquired alive he sometimes placed in charge of travelling showmen who, for this service, were the more ready to let him have this and other material when it was of no further use to them. Many animals were, however, kept alive at Earl's Court, these including two leopards, for Everard Home relates how they broke out one day and got into the yard among some dogs which

[2] 77, 253.





Figs. 1 and 2. The Caracal and the Sand Bear. Reproduced from Thomas Bewick's *A general history of quadrupeds* (1st ed., 1790).

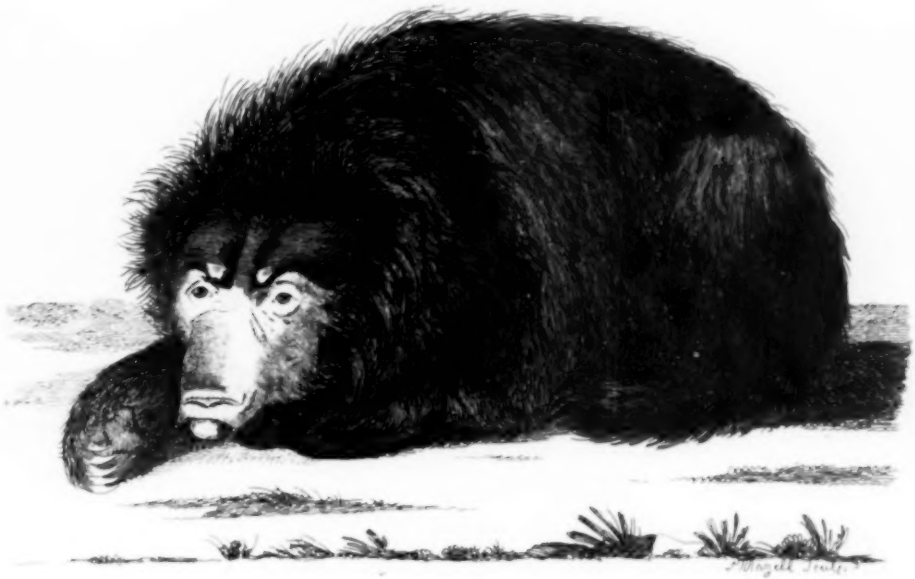
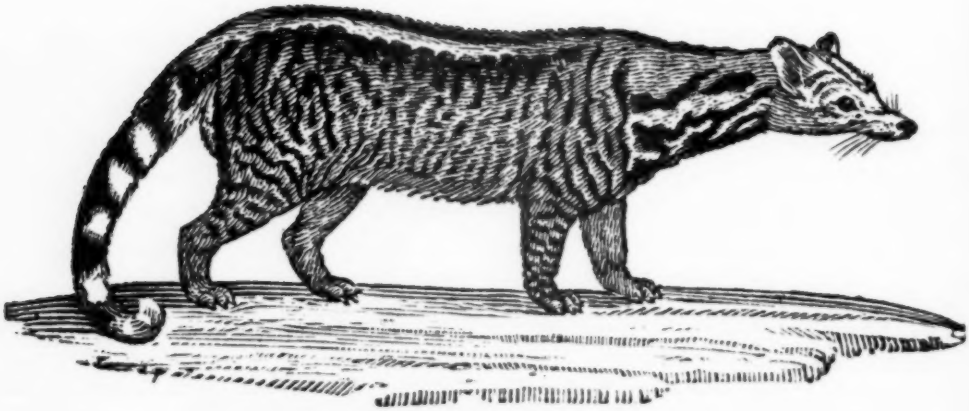
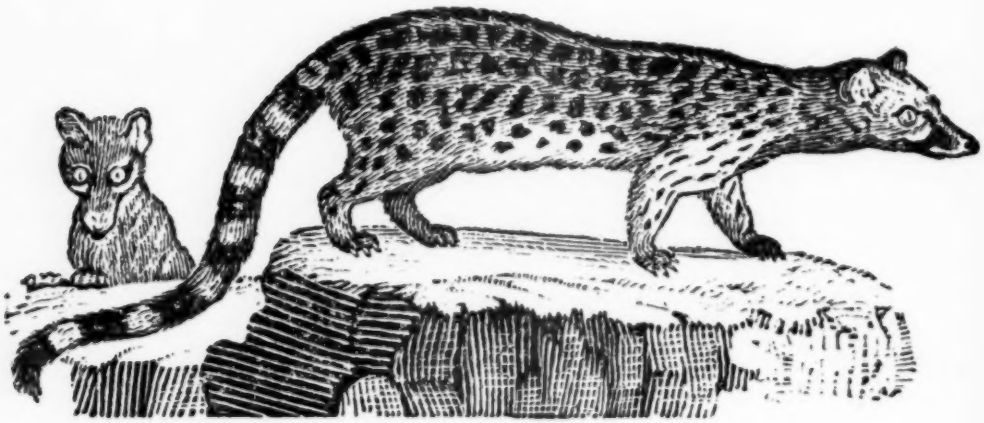
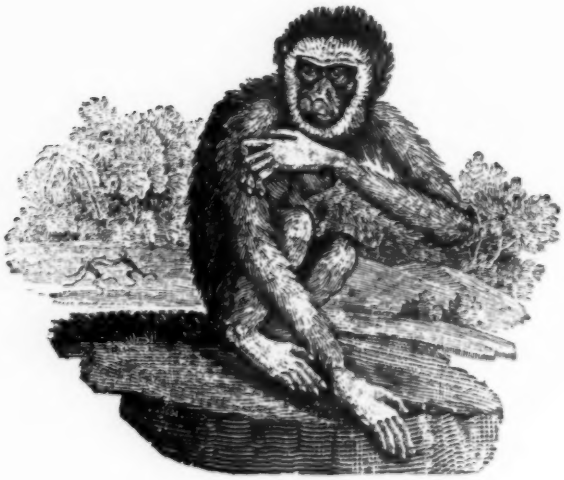


Fig 4. The Ursiform Sloth. Reproduced from Thomas Pennant's *History of quadrupeds* (3d ed., 1796).







Figs. 5, 7, and 8. The Zibet, the Genet, and the Gibbon. Reproduced from Thomas Bewick's *A general history of quadrupeds* (1st ed., 1790).

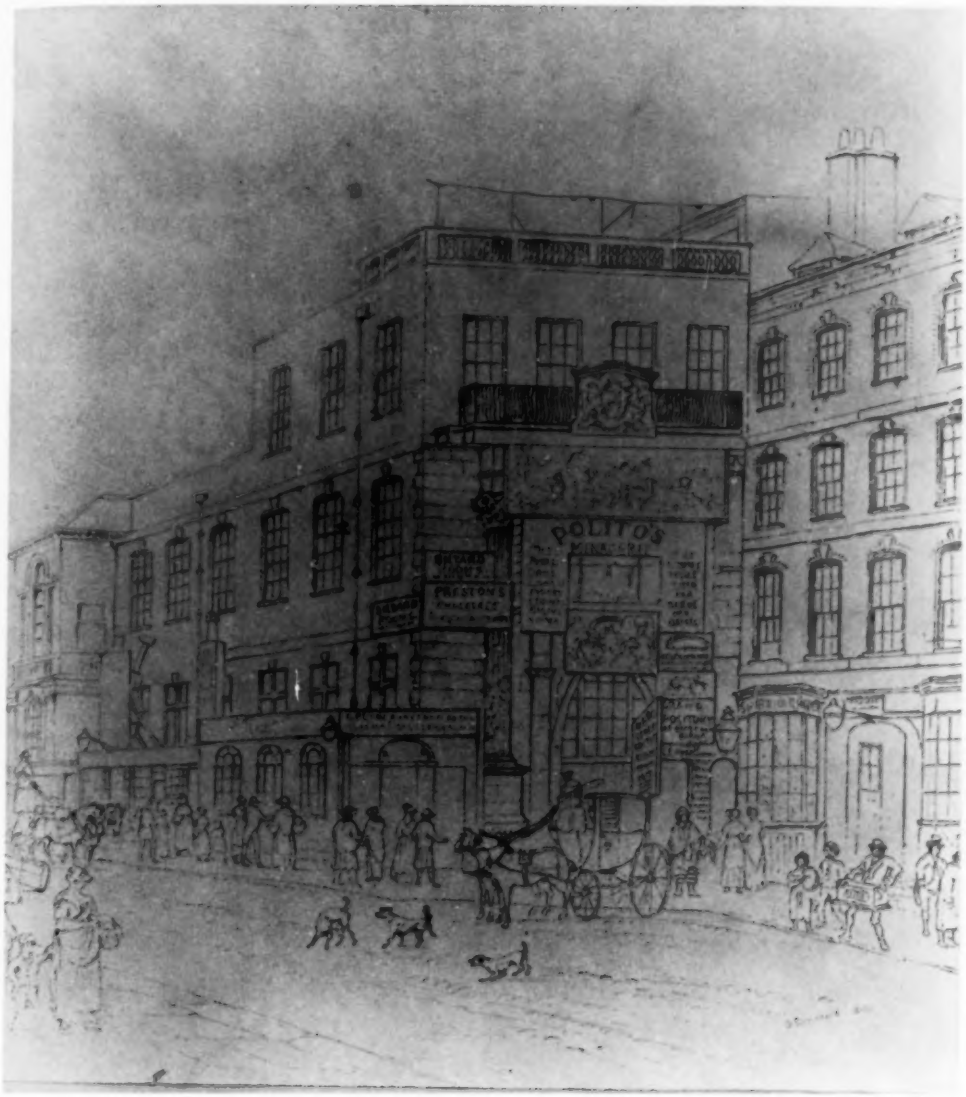


Fig. 3. Reproduction of a painting of Polito's Menagerie. (Courtesy of the Trustees of the British Museum.)

Fig. 6. John Hunter's Giraffe. The original water color painting is preserved among the Hunterian drawings in the Library of the Royal College of Surgeons.

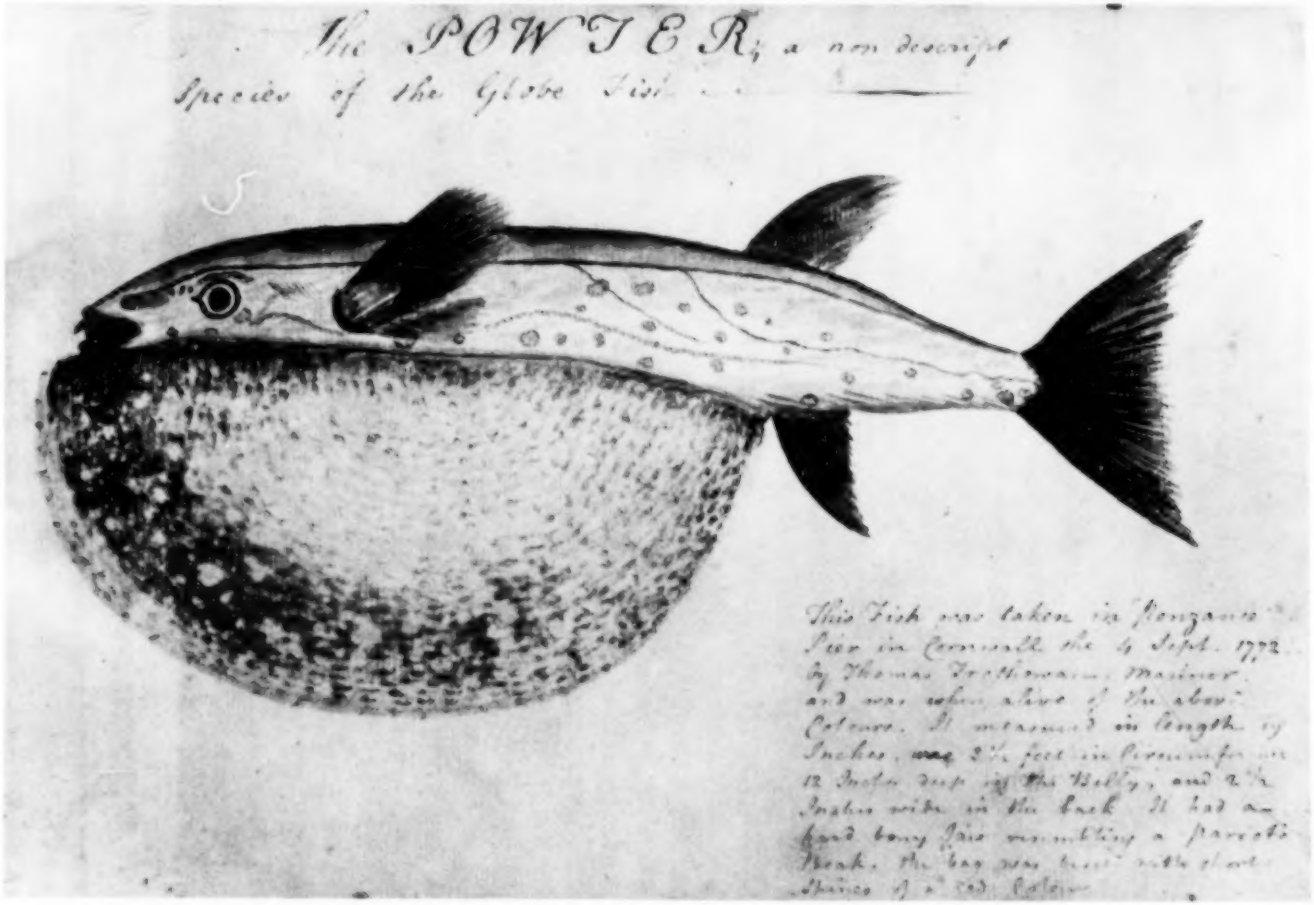


Fig. 9. An original painting, perhaps the work of John Hunter himself, of one of his specimens.

they immediately attacked; the howling thus produced alarmed the whole neighborhood.

Mr. Hunter ran into the yard to see what was the matter and found one of them getting up the wall to make his escape, the other surrounded by the dogs; he immediately laid hold of them both, and carried them back to their den; but as soon as they were secured and he had time to reflect upon the risk of his own situation, he was so much agitated that he was in danger of fainting.[3]

It was at Earl's Court that there were facilities for macerating carcasses, for the preparation of skeletons, and for disposing of unwanted material, including that from the London house. The larger boiler was still in existence when the house was demolished at the end of last century.

But by far the most regular and prolific donors of material for the museum were his friends, many of whom were naturalists themselves, like Sir Joseph Banks and Daniel Solander, his assistant. Among numerous other gifts, Banks gave Hunter a 'Sierra Leone Cat' (possibly a Serval), of which he was informed as follows: "If you will step in at Banks's in Soho Square you will find the corpse of a fine Sierra Leone Cat, the inside of which is at your service. The skin is to be stuffed for the British Museum." Others were explorers and travellers, like Captain Constantine Phipps (later Lord Mulgrave) and Julius Griffiths. In his account, *A Voyage towards the North Pole, undertaken by His Majesty's Command in 1773*, Phipps mentions that Hunter dissected some of the specimens found. One of Griffiths's contributions was 'the entrails of a Pangolin from Sumatra,' though in a note written to Hunter from No. 6, Queen Square on 'Thursday morning,' he mentions that they had been "entirely spoilt from their long detention at the India House" and goes on to say that he "will do himself the honour to call in a few days with the aquatic snail that he mentioned when he had the pleasure to accompany Mr. Broff to breakfast in Leicester Square." Griffiths had been apprenticed to John Gunning in 1779 and had attended as a surgical pupil at St. George's Hospital. He never completed his medical training for, as he says, thanks to an indulgent father he was allowed to live in Paris for two years, after which, having a taste for travel and adventure, he set out on a journey which took him through the Mediterranean, Asia Minor and Arabia, to the Persian Gulf and thence to Bombay, round the south of India and Ceylon

[3] Everard Home's "Short account of the life of the author," prefixed to the *Treatise on blood, inflammation and gunshot wounds.*

to Sumatra and Malaya, during which he suffered much hardship, danger, and privation.

As the years passed by, it seems that any new or 'non-descript' animals were more than likely to come into Hunter's possession. In this way he was able to investigate as much of the anatomy as possible from the skin and some of the bones of the first giraffe ever to come to this country (Fig. 6); and similarly of the first specimens of kangaroos, presented by John White, author of the *Journal of a Voyage to New South Wales,* published in 1790, and Surgeon-General to the Settlement. Some of these specimens can still be seen in the Hunterian Museum at the Royal College of Surgeons.

Hunter was particularly fortunate in the early days of his interest in comparative anatomy to become friendly with John Ellis, 'that bright star of British Natural History,' as Linnaeus named him. No portrait of him survives if one ever existed, but he is said to have been tall, his features strongly marked and expressive. In 1769, when he was about sixty years old, John Fothergill's niece recorded in her diary that he was "a very humorous comical old gentleman"[4] There is no doubt that Ellis had a profound and lasting effect upon John Hunter's career. He was one of the signatories to Hunter's application for election to Fellowship of the Royal Society and indeed Hunter's first paper before that body was read by Ellis on 5 June 1766 as a postscript to one of his own (*Philos. Trans.* 57, 307). Ellis had no academic, medical, or zoological training; he was the London agent for the Irish Linen Board and also for West Florida and Dominica. His interest in natural history was encouraged and advanced by the gifts of rare and unknown animals and plants from his business acquaintances in distant places. The paper to which reference has just been made was on the subject of a new "amphibious reptile," the Siren, the first specimens of which to reach this country were sent to Ellis by his friend, Dr. Alexander Garden of Charleston, South Carolina, after whom he named the gardenia. Some of the invertebrate animals now in the Hunterian Museum, as well as preparations of the Siren, were from Ellis' collection; Hunter also acquired many of the drawings, particularly of corallines and zoophytes, prepared for Ellis by George Ehret, the artist. Many of these are preserved in the Library of the Royal College of Surgeons.

[4] J. Johnston Abraham, *Lettsom.* London, 1933, p. 133.

Hunter was able to get at least two specimens of the Genet (Fig. 7); one was sent by 'Mr. Jennings' and the other was brought from the Cape of Good Hope for "Mr. Aiton at Kew who gave it to me." William Aiton may well have been a friend of the Hunter family for he was born near Hamilton, Lanarkshire. He came to London in 1754 and worked for five years as assistant to Philip Miller in the Botanic Garden, Chelsea. At the end of this time he was appointed gardener at Kew, then in the possession of the Princess Dowager of Wales.

Hunter numbered among his friends not only his scientific colleagues but several members of the aristocracy and others in government circles. These too gave assistance in providing material for the museum. Lord Shelbourne, (Prime Minister in 1782 and created Marquis of Lansdowne two years later), presented to him a black monkey, probably a gibbon, which animal forms the subject of one of Thomas Bewick's fine illustrations (Fig. 8). The 'Hog Deer' dissected by Hunter was a gift from Lord Clive (1725-1774), and the Yak was presented by Warren Hastings (1732-1818). William Clift states that this animal was brought back alive from India, so presumably it survived in this country for a number of years, because Hastings returned in 1783 and as late as 1791 George Stubbs made it the subject of one of his paintings for Hunter.

The River Thames in the eighteenth century could provide many additions to a museum that would be unthought of now. Porpoises entered the estuary in large numbers and afforded a welcome diversion to the watermen. More than a million lampreys were caught annually, and dolphins and whales were not infrequent. In 1772 from further afield came a specimen of a 'Powter,' caught off Penzance Pier on 4 September by Thomas Trethowan, a mariner. A drawing of this fish, possibly by Hunter himself, forms one of the collection of Hunterian drawings in the Library of the College. The notes upon it identify it exactly with a specimen in the museum (Fig. 9).

One of the difficulties Hunter experienced in making his museum complete was to have examples of the entire animal. So far as was possible he kept a large collection of undissected material and had a considerable number of stuffed specimens. Where this was not practicable, he commissioned paintings from such well-known artists as George Stubbs, Jan van Rymsdyk, William Hodges, and others, as well as employing artists as members of his house-

hold staff, such as St. Aubin and William Bell, for this purpose. The need for this was the greater since there were few accurately illustrated works on natural history available at that period. One of the best was the series containing the superb wood engravings of Thomas Bewick, some of which have already been mentioned. Bewick was born at Ovingham in Northumberland in 1753 and was apprenticed at the age of 14 to Ralph Beilby; between them they restored their craft to the popularity and high standard that it had formerly held in this country. Perhaps the best known of their works are the *History of Quadrupeds* (1790) and the *History of British Birds* (2 vols, 1797 and 1804). The text was mainly the work of Beilby, and Hunter's observations are noted several times as, for example, on the air sacs of birds and his opinion that the Ostrich, though a flightless bird, still requires these structures to assist its great running powers. With regard to swallows and the supposition that they hibernated—even at times under water—"the celebrated Mr. Hunter informs us that he has dissected many swallows but found nothing in them different from other birds as to the organs of respiration."

John Hunter's museum was unique in his lifetime, as it is now, for many reasons—not the least of which is that it presents a comprehensive picture of the structure and function in all those living things that it was in his power to obtain—a mirror of nature and of life itself.

Some Letters of Dr. Charles Goodall (1642-1712) to Locke, Sloane, and Sir Thomas Millington

KENNETH DEWHURST*

LETTERS may have certain advantages over printed sources in conveying impressions of the past, since many seventeenth and eighteenth century medical textbooks contain several defects which tend to obscure the contemporary medical scene. Physicians were usually so concerned about launching vituperative onslaughts on their colleagues that their works commonly abound with highly speculative hypotheses, interspersed with classical allusions and literary extravagancies. The elegance of a doctor's literary style was often more highly regarded than either the acuteness of his clinical observations or the efficacy of his treatment. The writing of popular medical essays and pamphlets was then one of the most common devices used by young doctors to get their name before a wide and credulous public, and hence we find that many medical books were written solely for mercenary reasons (or, as Smollett puts it, "to force a trade") rather than with the object of furthering medical knowledge. Smollett was, of course, able to write with some authority on this matter, as he had vainly hoped that his own *Essay on the External Use of Water* would launch him into a practice as fashionable as his newly acquired residence. This cynical device of deliberately setting out to attract public attention by publishing medical textbooks was encouraged by the eminent Dr. Richard Mead in this letter to a young physician:—[1]

> . . . Should you have an itching to make your name known by writing a book on physic, yet so customary, I will advise you to choose the subject by which you think you will get most money; or that will bring you the most general business, as fevers, smallpox, etc. . . . The method of writing, if in your frontispiece you address not your book to some great man, is to club with some other physicians; and thus by way of letters to commend each other's good practice, and to support and make each other favour. But above all things, take particular care, let the subject be what it will, that the words be well chosen, so to make up an elegant and fervid speech; since you have ten to one that mind the language more than the ideas.

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[1] John Nicholls, *Literary anecdotes of the eighteenth century*, 1812, vol. IV, p. 219.

Mead's advice was hardly likely to result in the reproduction of true and accurate records, and hence we often find that unpublished sources more truly reflect the temper of the times. Letters give the bare essentials of treatment without the speculative verbiage: they often offer a glimpse of the doctor's private life and his interests outside his profession. And correspondence between colleagues sometimes reveals professional relations and the way in which reputations are made.

With these random reflections I would like to present sixteen hitherto unpublished letters of Dr. Charles Goodall. It is doubtful whether any introductory justification is necessary, as Goodall was one of the leading seventeenth century physicians whose stout defence of the College of Physicians eventually led him to preside over its fortunes. But such details of his life have been long forgotten, and he is now remembered (if at all) as one of Sydenham's early friends and supporters who reaped that great physician's gratitude in the dedication of his *Schedula Monitoria.* These letters do, however, have some secondary historical value, as they were addressed to three eminent friends of Sydenham: John Locke (1632-1704), Sir Hans Sloane (1660-1753), and Sir Thomas Millington (1628-1703/4).

Born in Suffolk in 1642, Goodall was ten years younger than Locke, and eighteen years younger than Sydenham. He studied first at Cambridge where he was licensed to practise surgery in 1665, and on 21 June 1670 "he entered on the physic line at Leyden,"[2] graduating M.D. a month later with a treatise on scurvy dedicated to Richard Lower. During his early years in London, Goodall attended the anatomical lectures of Dr. Walter Needham, whom he eventually succeeded as physician to the Charterhouse, and he also served a clinical apprenticeship with Thomas Sydenham. He became a candidate of the College of Physicians in 1676 in which year he published a defence of the College against the criticisms of Adrian Hyberts. His book, *The College of Physicians Vindicated,* etc., briefly proved these three points: that the College was legally established; that it had justly exercised its legal rights; and finally its contributions to the growth of medical knowledge in England.[3] Sydenham's *Observationes Medicae* came out in the same year, and Goodall, already his disciple, immediately sprang to his defence when his views were criticised. Sydenham

[2] Sir Humphrey Rolleston, "Charles Goodall, M.D., F.R.C.P. (1642-1712)," *Ann. med. Hist.,* 1940, 3d ser. 2, 1-9.

[3] *Dictionary of National Biography,* vol. VIII, pp. 134-135.

showed his gratitude in a short treatise on the treatment of intermittent fevers (in response to Dr. Brady's request) wherein he discussed a patient referred to him by Goodall, "the mention of whose name reminds me of his candour, probity, friendship, and medical skill."[4] It was through his friendship with Sydenham that Goodall met John Locke who had returned in 1679 from three and a half years' residence in France.

While reading the Oxford arts course, Locke had become greatly interested in medicine and science under the stimulus of Boyle, Willis, and Lower. He did not, however, possess a medical degree when he became physician to Lord Ashley (later first Earl of Shaftesbury) and shortly after taking up this London appointment he became acquainted with Thomas Sydenham, with whom he served a clinical apprenticeship. While accompanying Sydenham on his clinical rounds, Locke was greatly struck by the efficacy of his methods, and in 1668 wrote a Latin poem in his praise which prefixed the second edition of his *Methodus Curandi Febris*. Politics, economics, philosophy, and diplomacy then turned Locke away from medicine for a few years until his patron's fall from power in 1675, when he returned to Oxford and graduated Bachelor of Medicine. He was elected to a medical studentship at Christ Church, but immediately afterwards chronic ill health drove him to seek a cure in the benign climate of Montpellier. During his residence in France, Locke met the leading physicians of the towns through which he passed, and his journals bear testimony to his continued medical interests. Hence, when Goodall made his acquaintance, Locke was an experienced and widely read physician, who was renewing his long friendship with Sydenham. Although Locke was not then practising medicine in a regular way, he still kept in touch with all aspects of the subject, and whenever he could spare the time from Shaftesbury's political affairs, he was often in the company of Sydenham, Boyle, Needham, and other physicians and scientists. He remained a diligent student of every facet of the medical scene, rather than an active practitioner, as is shown by the range of topics covered in his medical notebooks and journals. Locke was in the habit of jotting down details of medical information passed on to him by other doctors, and soon after meeting Goodall he made several notes on his recommenda-

[4] *The works of Thomas Sydenham*, R. G. Latham, Ed., London, 1750, vol. II, Epistle I, p. 8.

tion. The first of these, written in Latin, appeared on 17 June 1680:[5]

> Take 2 drachms of the fairest largest crystals of English [vitriol]. Dissolve in 1 pint of [aqua fortis]. Dose: 3 spoonfuls thrice a day which is to be increased as long as the patient's stomach can bear it. It cures leprosy. See Hartmann's Arcanum [vitrioli]. Dr. Goodall.

When writing on various steel preparations Locke mentioned one made up with oil of vitriol or spirits of wine for use "in the hotter patients and diseases Dr. Goodall thinks";[6] and a few days later he mentioned the latter's astringent saffron of iron as being effective in the treatment of dysentery.[7]

Goodall steadily advanced in his professional standing. In April 1680 he was elected a Fellow of the College of Physicians, and eighteen months later, Sydenham made his name more widely known in this laudatory passage of his *Epistolary Dissertation*:

> Dr. Goodall was the friend who, when many men ventured to assert that I had done but little in the investigation and cultivation of medicine, threw himself in the way of my maligners, and defended me with the zeal and affection of a son towards a father. Greatly, however, as I was overpowered by the obligation, I would never have given him undeserved praise; since praise and blame unworthily given are equally violations of truth. No one, then, will blame me if I say, that he is second to no one known to me; in as much as for many years that I have known him, he has injured no man by deed, or even word. What he is in his profession, if God grant him life, the world will soon learn. To an erudition, founded on the study of all works, ancient and modern, on medicine, he adds an exquisite skill in discovering the most subtle minutiae of practice, without which no man can justly be called a physician. This renders him all that the wishes of his patients could make him. . . .[8]

Such high praise from Sydenham brought Goodall closer to their common friend, Locke. They met quite frequently in 1682, judging by the entries in Locke's journal. Goodall passed on to him notes on purging infants with worms;[9] a rupture cure consisting of the oral administration of the leaves of unsowed vetches,[10] a garlic and honey syrup for treating asthma;[11] a preparation of sulphur and dog's rose for treating dysentery; and an effective method of stopping heartburn with 8 to 10 grains of sublimated sal ammoniac.[12]

5 Bodleian Library, MS Locke, f. 4, p. 121.
6 *Ibid.*, f. 5, p. 116, 5 Sept. 1681.
7 *Ibid.*, p. 119, 17 Sept. 1681.
8 Sydenham's *Works, op. cit.*, vol. II, p. 83.
9 Bodleian Library, MS Locke, f. 6, p. 60, 7 June 1682.
10 *Ibid.*, p. 67, 17 June 1682.
11 *Ibid.*, p. 73, 28 June 1682.
12 *Idem.*

Locke was then closely associated with his patron's declining political fortune. Hitherto, Shaftesbury had persistently sought to secure a Protestant succession by constitutional means, but as all his designs had been crushed by Charles II's arbitrary acts, he now set out to achieve his ends by revolution. There was, however, much dissension among the Whig leaders whose intrigues eventually leaked out. To avoid arrest, Shaftesbury escaped to Holland, where he died a year later, leaving Locke without a *pied à terre* in London. On 29 May 1683 Locke moved his belongings to Dr. Goodall's at the College of Physicians in Warwick Lane,[13] which became his London home for the next few months. But when he returned to his rooms in Christ Church, Oxford, Locke soon realised that his long association with Shaftesbury had brought him under grave suspicion of complicity in his patron's political designs, and in the autumn of 1683 he prudently sought asylum in Protestant Holland.

While Locke was an exile during the next five and a half years, Goodall steadily advanced his career in London. In 1684 he published two treatises in defence of the College of Physicians: *The Royal College of Physicians of London founded and established by law, etc.* and *An Historical account of the College's Proceedings against Empirics, etc.* The first tract gives an account of the Acts of Parliament, royal charters, and judicial decisions establishing the privileges of the College; and the other work gives details of all the prosecutions of empirics and unlicensed practitioners extracted from the College records, together with the biographies of the most distinguished fellows. These publications certainly advanced Goodall's standing in the College, since a year later he was elected Gulstonian lecturer. And in 1686 Sydenham dedicated his *Schedula Monitoria* to Goodall, giving as his reasons for doing so: "First because you have always been my good friend constantly by my side, and one whose patronage has protected me against all who have opposed me."[14] His other reason for honoring Goodall was because of

> the familiar and daily intercourse which has had place between us so many years, has informed you, more than any man living, of the amount of labour which I expended upon these notices respecting the history and cure of diseases which were the subjects of my previous dissertation—trifling as they were. . . . I am only free to confess, openly, that just as you are second to none in the art you practise—I speak within bounds—

13 Bodleian Library, MS Locke, f. 7, p. 106.
14 Sydenham's *Works, op. cit.*, vol. II, p. 187.

so also you are one whose equal I have never yet met for thorough honesty and integrity. Long may you live when I have ceased to be. High may you stand in medicine.

Sydenham then asked him to enlarge and perfect his observations.

Labour at this, and you erect a superstructure on the foundation that I have laid; yet so labour, that when you are better taught only a more repeated and a more extended experience you may freely and openly correct these errors in my own observations, whether of history or treatment, into which human imperfection may have led me. In doing this you will not hurt, after death, the memory of one who, during his life postponed all things to the advancement of medical knowledge. . . .[15]

Goodall took Sydenham's advice and began to collect information for a book on Peruvian bark, the wonder drug of the day. He got two friends to help him: Locke, who was well placed in Holland to get information from the Dutch East Indies, and Dr. Hans Sloane, who was about to visit Jamaica as physician to the Duke of Albemarle.

After spending his early life in Ireland, Sloane studied for four years at the Apothecaries Hall in London, and following further studies in Paris he graduated M.D. at the University of Orange in 1684. On his way home, by way of Montpellier, he met William Charleton, one of Locke's old friends, who asked him to take some seeds home. "Your seeds were sent by a very honest gentleman," wrote Charleton to Locke,[16] "one Doctor Sloane who delivered them to Doctor Goodall's Lady for you; if you please I shall enquire further about them. . . ." Locke[17] certainly knew of Sloane at this time, although they had never met. After serving a brief clinical apprenticeship with Sydenham, Sloane disregarded his advice and decided to visit the West Indies, partly in the hope of finding plants with specific medicinal properties, such as quinine, which was then meeting with exceptional success in the treatment of agues. Sloane is certainly the "ingenious physician" mentioned by Goodall in this letter to Locke,[18] which was clearly part of an earlier correspondence:

I thanke you for the figure of the leaf of the KinKina tree you sent me by your worthy and good Friend Mr. Charlton. I have compared it with some leaves taken out of boxes or bales of bark sent into England, which I have kept long by me. It doth very much resemble

15 *Ibid.*, p. 189.

16 Bodleian Library, MS Locke, c. 5, f. 58.

17 For further details of the relations between Locke and Sloane see Kenneth Dewhurst's "The correspondence between John Locke and Sir Hans Sloane," *Irish J. med. Sci.*, May, 1960, pp. 201-12.

18 Bodleian Library, MS Locke, c. 10, ff. 19-20, July 1687.

them and seems to be of the same kind. I thanke you for putting me in remembrance of pursuing that treatise I intended upon that subject, which I have for some yeares laid aside; having been engaged upon writing that History you mention, as likewise hindered by sickness, loss of my father, &c. I now design in good earnest to fit it for the press, and am in hopes (whilst I am thus engaged) I may get better information about it from a learned and ingenious physician[19] (an intimate Freind of mine) who is speedily going to Jamaica[20] with the Duke of Albemarle: I have drawn up the following set of inquiries with which I intend to furnish him and some other Freinds, amongst whom I do particularly request your assistance.

Queries to be proposed concerning the KinKina tree. To any of the Natives of Peru brought into Europe: To any Spaniards, who were born and lived some time in that Countrey: To any merchants who have long traded at Lima, Quito, or other parts of Peru: To any Priests who have Spent some yeares there: Or in case None of these can be found in Europe, to Antonio Giminez an eminent Physician of Lima, or any other inquisitive Physician or Naturalist, who may be found in that Countrey.

Where the KinKina trees cheifly grow, whether they be wild or propagated by Art, or both; what their size, figure, number, colour (of leaves, bark and wood), taste, and use amongst the Indians and Europeans inhabiting that Countrey are; when and how the first discovery of these trees and bark was made; As likewise whether they beare flowers, seed or fruit: How and when the Natives bark these trees, whether the trees are not thereupon destroyed, if not, what use are made of them: how they manage the bark in order to its transportation, what quantity they have transported in late years.

Questions to be proposed concerning the KinKina bark. To any Spanish or English Merchants living at Cadiz. When the KinKina bark came first into Rome or Spain, when into other parts of Europe: what different prices it hath been sold at, how adulterated, what quantity hath been imported into Europe by the Spanish Galeons in one voyage, and how many they may have made of late yeares especially since 1677 when this bark begann to be generally used, and how they have been fraighted therewith.

If you have any Freind at Rome I begge the favour of you to write to him to enquire of the learned Nazarius whether he hath published those observations he had by him de Corticis Peruviani usu vique ejus differenti in viris atque mulieribus quibus frustra datur which he mentionid in a letter wrote to my learned and good Freind Dr. Grew, An. 1680. If he would be pleased to transmit them to me either in print or Manuscript, I will do him all the right I can, when I publish my treatise on this subject.

If you have seen any books worth the reading which have been published about the Cortex since 80, be pleased to give me an account of them: as likewise how the Miscellanea Curiosa are sold in Holland: I have the first set of them, but want 5 volumes of the second, viz. 82, 83, 84, 85, 86.

My Eldest Son is now at home with me. He is four yeares standing at Cambridg next Christmasse. My youngest is at Eaton, whom I intend to take home at the same time: I design them both for physic, be pleased

19 Sir Hans Sloane.
20 Or Jamajaca.

to give me your advice about their education, and let me know what university you most esteem in Holland, whether Leyden or Utrecht, and what theur yearely expence may be there?[21] Charles (I feare) is inclined to a phthisis. Dr. Sydenham's son lives at home with him, hath severall Children and applies himself wholly to physic: He hath got the degree of Doctor in Scotland, and is to be admitted a Licentiate of the Colleg.

My wife and self give our humble service to you, being very glad to heare how well you enjoy your health in Holland.

Sir, I am,

Your highly obliged faithfull Ffriend and humble servant,
CHARLES GOODALL.

Locke sent him all the information he could muster, and on the back of the letter, endorsed "answered 7 Sept., '87," he made a note of Spon's *Observationes sur les Fievres et les febrifuges*, "12° Lyon '84," together with these prices of the *Miscellanea Curiosa*: '82: £2.16, '83: £3.12, '84: £2.16, '85: £2.8, '86: £3.6.

Locke was then friendly with Jean Le Clerc,[22] a native of Geneva who had lately been appointed Professor at the Remonstrant's College in Amsterdam. Le Clerc founded the *Bibliothèque Universelle*, one of the earliest literary reviews to which Locke contributed his first published work on a method of indexing a commonplace book, and later reviewed several books for him. It was Le Clerc who first published a French abridgement of Locke's famous *Essay*. When Le Clerc was ill during the winter of 1688, he consulted Locke who referred the details of his illness to Goodall, with a request for Sydenham's advice, which is contained in this letter.[23]

Sir, I begg your Pardon that I returned not an answere to your Letter before this time, which was occasioned by my own illnesse and Dr. Sydenhams. I have taken his advice in the case you sent inclosed in your Letter: which is, that the Patient should observe the following course for a month or 6 weeks time.

Rx. Limatur Chalyb. Exstract. Absynth āñ 2 ozs. M.S.A. ut f m. [ ][24] pil. e singulis drachmis f. pil. 12 cap 3 bis de die superbibend. haustu Julup alicujus appropriat ℰ gr.

Rx. Aq. Lact. Alexiter. Ceras. n. an 3 ozs. Gentian Comp. 2 ozs. Sacch. abbiss. q.s. ad grat.

Every third day he adviseth the use of any purging minerall waters instead of the forementioned pills. As for my own part, I think a course of the German Spaw waters would be of great use in this Doctors case. and if they passed not well or were apt to heat him, Let him now and then take the purging minerall waters a day: which Last I doubt not but he may have from the place he mentions, by reason that sort of

21 Punctuation doubtful.
22 The brother of Daniel Le Clerc (1652-1728), physician and medical historian.
23 Bodleian Library, MS Locke, c. 10, ff. 21-2, Feb. 1688.
24 Page cut for seal.

waters will bear carriage so well especially if he orders four gallons to be boiled to one Gallon, and then filtred and sent to him: One pint of which mixed with 3 pints of good drinking water, will purge near as well as 4 pints at the Spring.

I have on the other side wrott the queries I desire to have resolved about the Cortex, to which be pleased to procure an answere as soon as you can. My wife and selfe give you our hearty service and thanks for your remembrance of us.

I am,

Your obliged faithfull freind and Servant.[25]

Questions to be proposed concerning the KinKina tree. [The questions for the natives of Peru, etc., and the merchants at Cadiz, as in Goodall's letter of July 1687, with insignificant differences apart from an additional query at the end of the second section: "Whether a bough or branch of this tree could be procured?" A further section follows:]

Questions to be proposed concerning the Bark. To any Spanish Merchants living in London or to any Drugster.

When this bark was first used in England, the different prices it hath been sold at, what quantity hath been formerly and of late imported.

His next letter[26] brought Locke the welcome news that the Glorious Revolution had run its brief course, and William, Prince of Orange, had been vested with the power of conducting public affairs. Locke immediately took advantage of Goodall's offer and sailed for England on the same ship as Princess Anne, landing at Greenwich on 12 February 1688/9.

My worthy & deare Freind,

I know you can be no stranger to the wonderfull successe which God Almighty hath given to the Prince of Orange in his late undertaking to deliver our miserable & distressed kingdoms from popery & slavery, which mercy we in England esteem no lesse then the Israelites deliverance from AEgypt by the hand of Moses, God grant that we & our posterity may live our mercies.

I presume you have heard that the King went privately from Whitehall some few daies before the Prince came to St. James's with a design for France, but was stopped by some Fisher-men, & then return'd againe to Whitehall on the Sunday in the Evening, but on the Tuesday (being the day the Prince came to London) he retired to Rochester, & is said to have left the Kingdom last Sunday. On Munday being the 24th of this month, the Lords spiritual & temporal met at Westminster & pass'd the following Order.

We the Lords Spirituall & Temporal assembled in this conjuncture to desire your Highness to take upon you the administration of publique affairs both civil & military & the disposal of the publique revenue for the preservation of our religion, our rights, liberties & properties & of the peace of the nation.

And that your Highness will take into your particular care the present condition of Ireland & endeavour by most speedie & effectuall means to

25 No signature.

26 Bodleian Library, MS Locke, c. 10, ff. 23-24, 27 Dec. 1688.

prevent the dangers threatning that kingdom, all which we make our request to your Highness to undertake & exercise till the meeting of the intended convention the 22th of January next, in which we doubt not such propper methods will be taken as may conduce to the establishment of these things upon such sure & legal foundations that they may not be in danger of being again subverted.

Yesterday the Knights, Citizens & Burgesses which were in town & served in any of the Parliaments that were held during the reign of K. Ch. 2. As likewise the Lord Mayor & Court of Aldermen of the City of London & 50 of the Common-Council of the same waited upon the Prince & concurred with the Lords in the foremention'd request.

Sir I hope that this news will encourage you to return to London as soon as you can settle your affaires in Holland: if you please to come to my house you shall freely command what conveniencies that will afford, which I hope may not be unacceptable to you. My wife & self give you our heartie service & do wish you a prosperous & safe returne to England.

I am, your faithfull Freind & humble Servant,

CH. GOODALL.

Sir, Since my writing this letter Mr. Church-hill hath printed the forementioned Order, & the Princes answer, which he desired me to present you, with his service.

Sir Walter Young & Mr. Clerk I saw this day, who give you their service.

If your affaires will not permit you to returne speedily I hope you will not deferre your returne longer then the time when the Princesse comes for England, which I expect may be the latter end of Jan. or beginning of Febr. Give my service to Dr. Stanley, if you see him.

Locke stayed with Goodall until he found lodgings in Westminster and later, in gratitude to his former host, he presented his two sons with a number of medical books. But the younger son, Charles (1671-1689), had recently died of consumption at Oxford. Educated at Eton and Merton College, Oxford, where he entered as a scholar in 1688, Charles Goodall the younger, was described by Wood[27] as "a most ingenious young man." He was the author of *Poems and translations, written on Several Occasions and to Several Persons by a Late Scholar of Eaton* (1789), which were jointly dedicated to "the Countess of Clarendon and Mr. Roderick, Upper Master of Eaton School."

Deare Sir, My son Thom was this week to wait upon you, but missed of you at your lodgings: He is this morning gone into Suffolke & after 5 or 6 weeks stay there designs for Northamptonshire, if you please to write to him at your leasure, it may answer the end which your good advice was design'd for; I will let him know how kind you have been in the books you have sent him, & do intend to send them into Northamptonshire; But as for the books sent to my deare Son Charles (the son of my hopes & staff of my Family) they can be of no use to him, He dying at Oxford on Saturday last to the greif of all that knew him or had heard of him. I

[27] *Athenae Oxonienses*, Philip Bliss, Ed., 1820, vol. IV, p. 256.

am sure you cannot but pity his poore Mother & sympathize with your afflicted Freind, who is & ever shall be Sir,

Your Obliged faithfull Freind & Servant,

CH. GOODALL.

I received of your Man the 1-6s-4d laid out for your use.[28]

Sydenham died on 29 December 1689, just when Locke was urgently in need of his advice in the treatment of a chronic cough which did not, as was customary, clear up with the Spring. As he was still expectorating purulent sputum during the summer months he thought that he had phthisis and sought Goodall's advice. In his reply the latter[29] recommended Dr. Morton's pills, and offered to arrange a meeting with him:—

London, May 21, 1690: Deare Sir, I heartily begge your pardon that I have not long since returned my thanks & answer to your last; the truth is, my wife hath been so ill lately, & now being at Hogsden, I have been so engaged that I wanted an opportunity to do it, till now. I know that you are so much Master of our profession, that I can offer little which may be more serviceable to you, then what you already know; Neither can I pretend anything extraordinary in your case. I thinke that Countrey aire, diet, & attending symptoms are of greatest use, though I know some particular medicines are not a little recommended by Authors, whether deservedly or no, I cannot tell. Bals. sulphuris Anisat. Terebinth. Syrup Dyasulp &c are good medicines, if not contraindicated by the Fever which generally accompanies this distemper, & perhaps indicates now & then gentle bleeding, & the frequent use of the cortex. Dr. Morton[30] doth highly commend the following pills.

Rx pulv. Milliped. prep. iii. drachms Gum Ammonias optime depurat. 1 drachm flor. Benzoin 1 drachm Extract croc. Bals. Peruv. āñ 1 scruple. Bals. sulphuris Terebinth. vel Anisat. q. s. m. f. pil. mediocr. deaurand. vel pulvere glychorh involvend cap. iij ter in die & cochl. syr. vel linctus alicuius convenientis superbibend. haust. Apoz[ematis] pectoral. calide.[31]

The Doctor hath wrote an admirable book de phthisi, which if you have not read, tis highly worth your reading & considering & if you will appoint any day when you will dine with me about 2 of the clock, you may have an opportunity to discourse the Doctor after dinner.

Be pleased to write me a word where I may wait upon mr. Furly, or how I may settle a correspondency with him about the Iron spaw waters, you will herein very much oblige your faithfull Freind & servant,

CH. GOODALL.

Goodall had succeeded Needham as physician to the Charterhouse, and Sloane, having returned from Jamaica two years prev-

[28] Bodleian Library, MS Locke, c. 10, ff. 25-6, 17 May 1689.

[29] *Ibid.*, ff. 27-8, 21 May 1690.

[30] Richard Morton was an Anglican clergyman who began to practise medicine when he became a nonconformist. He was created M.D. (Oxon.) in 1670 on the nomination of the Prince of Orange.

[31] The formula is printed in R. Morton, *Phthisiologia*, London, 1689, p. 166 (English trans., 1694, pp. 151-152).

iously, was now rapidly acquiring a fashionable practice at his home in Russell Street, Bloomsbury, where he received this letter:[32]

Sunday morning, April 17th, 1692: Good Sir, I was the last night to see Mr. Woodward and promised him to discourse you this morning about his case, and likewise to consult our freind Dr. Morton.

I sent my man this morning about seven, to wait upon you, but it seems you were gone out earlier.

Pray be so kind to call upon me as soon as you can, which will oblige,

Your faithfull freind & servant,

CH. GOODALL."

When Locke received this next letter[33] informing him of the death of Goodall's wife he was living at the country home of Sir Francis and Lady Masham in Essex. He spent the winter months there, returning to London during the summer where he worked as a busy civil servant.

London, April, 1696: My old and worthy ffriend, It hath pleased Allmighty God in his providence to deprive me of an excellent wife, with a considerable estate, since I had the happinesse to see you; she after about 3 weeks or one months sickness (or rather keeping her chamber) dying of a Diabetes, which though not very much in quantity, yet so dispirited her, that no remedies which my Freinds or self prescribed would do her service but her life and strength was carried away with her mind, thus I am once more and very unexpectedly rendred unhappy and unfortunate; which the more afflicts me because I am left without a Companion or Freind to discourse or advise with in my disconsolate condition: If therefore you would favour me with your company, when you come to town, you should have the command of the best chamber and other conveniences which my house will, or can afford: And I hope that the situation and airiness of the place with your Masters and Officers good company might contribute to your health and longer continuance in town, when you shall make us happie with your Company; which is what I do desire and value more than any other, whom I know in this world.

I have another request to make, which is, that if you know a stripling about 16 or 18 yeares old, who hath had the Smallpox, can read and write, and have been bred up in any Gentlemans service, and is of a sober life; you would be pleased to recommend him to my service, who shall not be backward to give him all due encouragement.

I shall likewise be glad to heare that you have made any further observations about the influence of the aire in reference to acute or chronical diseases, as also Endemicall or Epidemical; what you meet with in travels or other books relating to that subject, be pleased to communicate to.

Dear Sir, Your ever obliged faithfull ffreind and Servant, CHARLES GOODALL.

32 British Museum, MS Sloane 4078, f. 117, 17 April 1692.

33 Bodleian Library, MS Locke, c. 10, f. 29, April 1696.

Goodall's last letter shows that he was interested in carrying out a survey in social medicine, with particular reference to the weather and its influence on the incidence of epidemic diseases. This was one of Locke's[34] earliest interests: it was also one of his last. Ever since his undergraduate days Locke had made daily weather observations, and had collected much information on the mortality rates in the various cities in which he had resided. He therefore readily agreed to co-operate with Goodall and he sent this questionnaire to several of his foreign medical friends:

Enquiries to be made about Bills of Mortality, Aires, Diseases, etc.

1. What Bills of Mortality are kept in foreign Countreys either as to the diseases of which persons dye or the Number who dye weekly, monthly or yearly in most Capitall Citties or Towns of Europe, or in other parts of the World: as Paris, Madrid, Amsterdam, Venice, Hamburgh, Rome, Constantinople, Smyrna, Dublin, Edinburgh, etc. As also in New England, Barbadoes, Jamaica and other Plantations.

2. The Aire of different Countreys with the temper and alteration of the same at the severall seasons of the year and the diseases these countreys are subject to, and the time when?

3. The opinion Phisitians have of Jesuits bark and the best Account they can give of it.

4. The Esteeme which Phisitians have had of Doctor Sydenham and his Works.

5. The order observed in foreign countreys as to Phisitians, Surgeons, Apothecarys and Hospitals for the Improvement of Travellers and young Students.[35]

Dr. Willoughby,[36] Registrar of the Dublin College of Physicians, sent an excellent account of state medicine in Ireland to which Sir Patrick Dun, President of the Irish College, added his own observations. Then, through Locke's mediation, Dr. Pieter Guenellon sent this report from Amsterdam:

The enquiry of your friend is very wide and it would be easier to learn most of what he requires in London than here, that is if he is counting those dying in Madrid, Paris, Venice, Rome, Constantinople, Smyrna, Dublin, Edinburgh, Barbadoes and Jamaica. For Amsterdam a public account of death is made weekly, without saying as I remember they do in London, what was the cause of death.

Your friend must know, as regards his second article, that we have *De Bartola Medicina Danorum* and *De Bartius Medicina Indorum* and that in the description of different voyages he can gather what he requires.

As for his third article, if I understand aright, he asks what is our opinion of quinine. We believe it to be a very good remedy, but one which

34 For further details see Kenneth Dewhurst's "A review of John Locke's research in social and preventive medicine," *Bull. Hist. Med.* (in press).

35 Bodleian Library, MS Rawlinson, c. 406, f. 68.

36 Published by Kenneth Dewhurst, "The genesis of state medicine in Ireland," *Irish J. med. Sci.*, Aug. 1956, pp. 365-84.

it is improvident to use in a fresh intermittent fever where the regular action of nature expels the morbid matter, as well as in fevers accompanied by large obstructions. But it is of great help in long-standing fevers, and those in which the symptoms give cause for fear. In any case it is certainly now used here more than ever.

As regards the works of Mr. Sydenham we value them highly; his plan and method are certainly admirable. However, he has not had equal success in every direction and his remarks on gonorrhoea are very feeble, and one would often go wrong following his method.[37]

Finally our regulations for the rank of doctor, surgeon and apothecary are the same here as formerly, and at Leyden there is always a professor who gives practical demonstrations on certain patients in the hospital to teach the students. We intend to do the same here. Mr. Bernagie,[38] by the influence of his friends, was allowed the chair of Professor of Medicine in this famous school.[39]

Locke copied these details in his notebook, together with this additional information from Guenellon, which he then passed on to Goodall.

The yeare 1691 when they had a great Epidemick in the Autumn, the Number of the dead that yeare was 9002. In the yeare 1692, 6977 were the usuall proportion of other yeares. This is remarkable that though the Town be of a low situation and in a Marsh, yett the people live more healthy there than in higher situations in high places of these provinces. And it hath been observed more then once, that when the Plague or any other Epidemick hath reigned in this Countrey as in the yeare 1691, this Town has suffered least. They died then at Harlem 4 to one in proportion to this Town and double every where else.[40]

Unfortunately, Goodall never completed the survey on quinine nor this social survey of epidemic diseases, owing to his many other commitments at the College of Physicians. He was Harveian Orator in 1694, and was appointed a Censor for the first time in 1697. Sloane was also well known from the time of his appointment as secretary of the Royal Society in 1693. He succeeded in reviving the publication of the *Philosophical Transactions,* which had lapsed during the previous seven years, and these duties, entailing the soliciting of papers from potential authors, gave him a wide knowledge of natural science. Hence, it was from Sloane that Goodall now sought items of information on out-of-the-way matters such as these:

[37] In his treatise on Venereal Disease (1679), Sydenham merely recommended strong purges in the treatment of gonorrhoea (see Latham [n. 4], vol. II, pp. 31-37).

[38] Dr. Pieter Bernagie (1656-1699) combined the posts of Professor of Medicine and Director of the Amsterdam State Theatre. He wrote on the therapeutic benefits of tea in the *Pharmacopoea Amstelodamensis* and was friendly with Locke when they were members of a small private medical club in Amsterdam.

[39] Bodleian Library, MS Locke, c. 11, ff. 49/52, 3/13, Aug. 1962.

[40] Bodleian Library, MS Rawlinson, c. 406, f. 83.

Charterhouse, 25th January, 1697: My old freind, Pray do me the favour to consult your books and to send me word per penny post (as soon as you can) the quantity of the two following Arabian Measures, viz.: Tasauagi & Kerates.

I have not Agricola de ponderibus et mensuris, but tis probable that he may inform you.

Your kindness herein will oblige, your faithful freind & servant,

CHARLES GOODALL.

I should be heartily glad to see you at my house and to spend half an hour with you.[41]

Charterhouse, 28th January, 1697: Good Sir, I wrote to you some days past to request you to consult Agricola de Ponderibus et mensuris and what other Authors can assist you to explain the following Arabian Measures, viz:—Tassaugi & Kerates.

Be pleased likewise to write word what books you have or ever saw, which were wrote by Rhasis or Serapion.

Your answer to this letter will lay an obligation upon, Your faithfull freind,

CH. GOODALL.[42]

Charterhouse, November 26th, 1697: Dear Sir, You will oblige me, if upon the receipt of this letter you write word what your opinion is about the internal use of Cantharides, and what Authors have treated on that subject, and where the quotations are to be found? If you can favour me with an answer this day, I shall own it as a particular favour; And if you have any Authors hath wrote or professe on that subject, let me have an account of it, the sooner you return an answer to me, the greater obligation you will lay upon, Sir, your faithfull freind & servant,

CH. GOODALL.[43]

The next three letters show that Goodall was very much absorbed with the affairs of the College, of which Sloane was also a Fellow. He was ill in January 1699, when he asked Sloane to call on him:—

Charterhouse, June 4th, 1698: Good Sir, If business will permit pray meet me this evening at Three Tunn Tavern in Newgate Street, betwixt seven and eight of the clock, it being about an affair which doth very much concern yourself as well as, Your faithfull freind,

CH. GOODALL.[44]

Charterhouse, 1698: Good Sir, My freind Mr. Boulton (the bearer hereof) being unexpectedly reflect on in a late pamphlet entitled "The late Censors deservedly Censured" hath resolved to returne an answer to that, and Sir Groenwell late book published in Latin.

He wants several Authors quoted by him; and desires the favour of you to supply him with them.

41 British Museum, MS Sloane 4037, f. 17.
42 *Ibid.*, f. 19.
43 British Museum, MS Sloane 4036, f. 375.
44 British Museum, MS Sloane 4037, f. 80.

If you please to oblige him with them I will send my man for them, at such time you please to appoint, and will take care that they shall be thankefully and carefully returned.

Pray send word whether you have Cardan de Providentia ex anni Constitutione.

Be pleased to take no notice of this letter till I am so happy as to spend a little time with you, who am your faithfull freind and servant,

CHARLES GOODALL.[45]

Charterhouse, Sunday night, December 11th, 1698: My worthy freind, This is to desire you to give no encouragement to Mr. Boulton about supplying him with books or assisting him in any project till I speake with you; the reason you shall fully know, when I see you; till then let me oblige you by the ties of ancient freindship to take no notice of these lines, from Sir, your faithfull freind,

CH. GOODALL.[46]

Charterhouse, 9th Janunary, 1699: My old & worthy freind, You will oblige me; if you please to call upon me at my house on Thursday next in the forenoon, that I may have one houres free discourse with you in relation to my own health, and some other affaires of moment.

And when you come; pray bring with you an account of what Authors have wrote de morbis spiritum; And of them who have wrote & professe against profuse or immoderate bleeding;

You will hereby oblige an old and faithfull freind of yours who will always approve himself, Yours,

CH. GOODALL.

If you cannot spare one houre on Thursday forenoon, let it be Friday or Saturday, rather then faile.[47]

As his health did not improve, Goodall consulted Sir Thomas Millington (1628-1703/4), then President of the College of Physicians. After graduating from Trinity College, Cambridge, Millington transferred to Oxford, was shortly afterwards elected to a Fellowship at All Souls where he was chamber fellow with Thomas Sydenham whose friendship he thereafter retained.[48] After proceeding doctor of medicine in 1659, Millington was appointed Sedleian Professor of Natural Philosophy in 1675. He had known Locke and Lower at Oxford, and, as a founder member of the Royal Society, he was also acquainted with Sloane: he was equally well esteemed by Goodall as a staunch defender, benefactor, and President of the College of Physicians. When Goodall's health began to improve, he sent Millington this description[49] of his daily routine at the Spa, together with an account of his persistent

45 *Ibid.*, f. 143.
46 *Ibid.*, f. 170.
47 British Museum, MS Sloane 4037, f. 366.
48 J. F. Payne, *Thomas Sydenham*, London, 1906, p. 67.
49 Bodleian Library, MS Rawlinson, c. 406, ff. 61-64 (letter undated).

attempts to revive the Earl of Kent,[50] who collapsed and died on the bowling green:

Tunbridg Wells: Honoured Sir, After 16 weeks continuance at Tunbridge Wells; I thought it a duty incumbent on me to acquaint you what successe I had found drinking the waters, so long a season. For the first Month, I observed little alteration; but after 6 weeks time, my stomach grew sensibly better, my strength and spiritts were much recruited and amended, so that I would walk up hill with more ease and pleasure than at London, or at my first coming to Tunbridge. I bless God, that I can now eat and drink, study and converse with an easie cheerfull and contented heart, I usually spend 2 houres in an Evening at Bowls and return from the Green better than I went to the same, my water passe well and my legge grow sensibly lesser and stronger; and that which is most surprising I am not so affected with change of weather as I have been for above 50 years past, and whereas (from the time I came from the Bath last Michaelmas) I used to take 50 or 60 drops of Laud. bis die; I have of late contented myself with 30. This great alteration and advantage which I have (through Gods blessing) received from the waters doth lead me into the following Opinion. That in all Chronicall Cases of the blood and tone of the partes are very much weakned and debilitated. Hypochondriacal and Hystericall affections, cachothymies, Cachexies, ill habits of Body etc. are not to be cured without a long course and continuanuce of the waters; for notwithstanding I found the great and eminent advantage, which I have mentioned by drinking these waters 8 or 10 weeks; yet I would not overcome one symptom which was (as I feared) entailed upon me by my long and tedious malignant feaver, viz. fulness and swelling of my thighs, and leggs especially in an afternoon and evening, and much worse upon riding and when by a longer continuance of these waters, this was conquered, that yet there remained a hardness and tenseness of my legs that I could not think the flesh (of them) true natural flesh; they seeming to want that liveliness and pliableness, that is proper to flesh rightly influenced with the due influx and circulation of the blood, and spiritts yet to my great surprise and admiration; I found that by an obstinate continuance of drinking these waters 15 or 16 weeks the swelling disappeared; so that I could daily ride with ease and pleasure and that obtuseness and tenseness of the muscles was conquered and then these muscles of my legs grew as pliable and obedient, as in my youthfull yeares, so that I am now in reasonable hopes that I may heareby be enabled (through the blessing of God) to redeem (in some Measure) part of that most precious and valuable time which I have lost for many years past, by a weak sickly, infirm and shattered constitution of health and from hence forward dedicate and devote myself more sincerely and heartily to the Glory of Almighty God and service of the faculty and College of Physicians of which I am a member. May you long live President of the College of Physicians to see that unhappy ill natur'd society united, so as to respect each other as well as (to our shame be it spoken) the Apothecaries do. May you live to see your son and

[50] The second Earl of Kent (1645-1702) was educated at Trinity College, Cambridge where he graduated M.A. in 1661. He was one of the Sword bearers at the Coronation of Queen Anne. He died on 19th August 1702 (*Complete Peerage*, H. A. Doubleday and Lord Howard de Walden, Eds., vol. II, p. 176).

daughters married to their happiness and your content. May you live in honour and reputation (first and principall Physitian to our Gracious Sovereign Queen Ann, whom God long preserve) to a greater Age than any of your famous and learned predecessors. May your fame and success exceed our renowned Linacer, Caius, Prujean, Mayern, Bates, etc.; may your Name be admired and conveyed to posterity with the deserved stile and title of Immortal, as the renowned Dr. Harvey. As to the Company which we have had at Tunbridge this season, they have been as many in Number (tho' not in Quality) as the last and many preceeding years; we have had the Company of 4 or 5 of the Nobility; more divines than usuall and severall of considerable Wit; so that they were many more then those of our faculty; whose Business was not so fortunate and considerable as in former years. The Gentry were in Number as usuall, The Citizens more numerous, as also Ladies, Citizens wifes and (Children especially) more then enough. The most considerable accident which happened this season was the suddaine surprising death of that great and eminent peer the Earl of Kent the time and full History of whose Case is the following.

His Lordship came very well to Tunbrid Wells and continued so for about 12 daies. He used no manner of exercise whilst he stayd, but only walking aftere morning prayers for an hour or two and sometimes after evening prayers or on the bowling Green at Mount Sion. On his Lordship's last and fatall day I walked with him from the chappell 2 or 3 hours on the Walks, he then made an appointment to meet at 5 in the evening to play Bowls which he had not done before nor drunk the waters during his continuance with us. I went at time appointed, and found my Lord on the Green before I gott thither engaged in bowls (if I mistake not) with the Lord George Howard, Lord Kingsale and Sir Thomas Powis and I gave him an account of some News of which he had not heard which occasioned some discourse between us, then he went to his Bowls and plaid (I suppose) 2 or 3 games. I went to the other end of the bowling green and plaid one game and part of a second, when on a suddain there was cryd Lord is fallen, of Lord is fallen, A surgeon, a surgeon, upon which I left my Bowls and ran up to his Lordship and found him dead on the Ground he having neither pulse nor Breath; but only one or two small rattlings in the throat, His Eyes being closed. However he was bled immediately on both Arms to the quantity of 10 or 12 ounces as computed. In the mean time putt up the strongest snuff and sp. sal. Arm: into both nostrills and ordered 2 ounces of Lin. Benedict. to be brought with all speed. The Apothecary (Mr. Thornton) sent for 3 ounces which he poured down his throat, not spilling one drop. As soon as this was done we carried my Lord (in a chair) of the bowling green through the dancing room into a very sorry bed chamber one pair of stairs. I supported his Lordships head (which otherwise would have fallen on one side or backwards or forwards) with my hands and breast, till he was placed on a bed in a little room, when this was done, I cryed out for a surgeon to apply 6 or 8 cupping glasses to his Lordships shoulders with deep scarification; But no surgeon or Apothecary (Altho one of the former and one of the latter were present) had any, neither was there any to be had on the walks (as was answered by the surgeon or Apothecary present) nor could have been promised; if the Queens life had lain at stake on Tunbridg

Wells, when I found my self thus unhappily disappointed, I ordered his head to be shaved and a larg. Blister to be applied to Capiti raso, as also another to the breadth of Neck and shoulders. At the same time I sent for 2 or 3 ounces Tinct. sorza. mixed with 2 ounces of Syr. ē Spin. Ceodin. which I poured by spoonfulls into my Lords Mouth and throat, all which passed into his stomach.

After this was done, the News of this misfortune reached the walks, so that doctor Branthwait[51] came to my Assistance who proposed the giving Sp. 6 scruples in a proper Julep which was done.

Then Dr. West[52] came who advised a frying pan made red hott to be applied to the head (the blister being taken off during the time and after put on) however there appeared not the least breath, pulse or life in my Lord (tho' one or two physitians thought that there was some little umbrage thereof, or at least Micatio pulsuum) so that in short we had very slender hopes of his Lordshipps Case or little or no encouragement from any application used.

The room in which my Lord was laid, was so crowded with Lords and Gentlemen (as particularly the Lord George Howard, Lord Fanshaw, Bp. of Glocester (his Lordshipp Tutor) Sir Thomas Powis, Sir Wm Scrowen, etc.) That I was forced to request them to walk into another room (lest my Lord might want the benefitt of Air) and to suffer none but necessary Attendants to tarry with him.

When all these things had been done (as related) the Bishop of Glocester obliged me to wait on him to my Lords beloved daughter who lodged near Southborough (about one mile from the Wells) who had heard Nothing of the suddain unexpected and surprising death of her most dearly beloved Father: she was (as must be imagained) upon the hearing of the News in a very great passion, crying out is my Lord dead, Is my Lord dead; tell mee my Lord plain truth which being owned by the Bishop, that his Lordship, was dead, and of an Apoplexy; she asked him whether Cupping glasses had been applied, and resolved to go to her dear Father; But that being prudently prevented she positively told the Bishop that she neither could nor should be satisfied unlesse her Father was brought to his own lodging; which was both promised and performed. It being my Judgement that the Motion of the coach with the warmth of my Lords servant, who kept his Body in an upright erect posture, (by grasping him round the waste) might conduce to the operation of the vomit and purge which had been given him some hours before if there was the least warmth or life left in his stomach or Bowells; which might be so, tho' indiscernable to us. In short it was desired by the Bishop of Glocester that my self Dr. Brantwait (with a Surgeon and Apothecary) might attend his Lordship to his lodgeings and do what further we thought fitt which was accordingly done; And as soon as his Lordship was putt into his warm bed we ordered several pipes of tobacco throughly lighted to be blown up the Anus which we thought might be of use; when we could not have the Advantage of Tobacco Clysters.

51 Dr. John Branthwait was educated at Cambridge where he became a Fellow of Caius. He graduated M.D. (Cantab.) in 1700, in which year he was admitted a Candidate of the College of Physicians, being elected a Fellow three years later.

52 Probably Thomas West, M.D. (Oxon.), who graduated from Merton College, Oxford in 1696 and was admitted a Fellow of the College of Physicians in 1718. He died in 1738.

After this was done upon a suggestion of Dr. Edmund Kings,[53] the bowells of a sheep killed in the house now applied to his Lordships stomach and Belly, but all without the least success though we were reasonably encouraged to make use of all proper remedies in so great a case, many Apoplexticks having come to life a considerable time after they appeared dead to all humane sense.

Thus fell this Great and Noble peer, much lamented by all who knew his Lordship. His case was so suddain and surprising, that some were of an Opinion that his Lordship did not die of Apoplexy, but of a syncope or Impostume asserting that if his Lordship had died of an Apoplexy, his death would not have been so suddain but pulse and respiration would have continued, at least sometime; but neither of these opinions I could embrace for the reasons following.

As to a Syncope to which some persons imputed the suddain death of his Lordship it could not be the Cause because they who die of this distemper either suffered immoderate profusions of blood, or great evacuations whereby the blood and spiritts are so weakned that Nature cannot supply the Animal and vital faculties or are seized with a polypus Cordis, or also emaciated to that degree that their spiritts are so exhausted; that Nature is forced to succumb; tis true, that we have here and there an extraordinary Case, where some persons die as it were on a moment upon some suddain surprising news of the death of a neer and dear relation; or from some extraordinary and unreasonable exultation of Joy; In the fervour of which the spiritts are so depressed, eclipsed, or clouded that nature cannot supply a sufficient quantity to perform their due offices, But for want of them the persons die on a suddain.

In the latter the spiritts are so elated, and the Exultation of Joy is so great, that they cannot be kept within the due bounds and conduct of Reason: but press in such a quick and violent torrent through the Nerves in the Heart, Lunges, and Animal parts that they are dissipated in a Moment. In a polypus cordis, I own suddain death must necessarily argue from the suddain coagulation and stagnation of the Blood, whereby its circulation is totally obstructed and the heart rendered immoveable.

They who assert that his Lordship died of an Imposthume, did not well consider the nature and cause of that distemper for where that is found the cause of any persons death there ordinarily preceeds some contusing fall, Aguish indisposition, Head Ack, or the like symptoms which generally are very troublesom and painfull, tho' in the slightest Impostumes. Besides an Impostume of this sort must have required length of time to collect such a plenty of matter as was capable to depress the Brain, to such a degree as to cause a fatal or total Apoplexy, there must likewise have been great and long complaints of dulness and heaviness as well as a continuall load or weight, and obtuse pains etc. none of which symptoms were observed or complained of (in the least degree) in my Lords case, He being in a perfect state of health before he came to Tunbridg and whilst he continued there, and in his naturall constitution was very healthfull and temperate in his living as well as carefull to maintain that happy condition of health with which God had blessed him.

[53] This may have referred to Sir Edmund King, who began practising as a surgeon until he was created doctor of medicine by the Archbishop of Canterbury. He incorporated at Cambridge in 1671. He was admitted a Fellow of the College of Physicians in 1687. He died in 1709.

The truth is, they who propagated the opinion of his lordship dying either of a Syncope or Impostume had not allowed themselves time to consider the Nature of an Apoplexy for had they done it, they would have distinguished betwixt a total and partiall Apoplexy. In the former of which (I mean the carotid and vertebral Arteries) which convey the blood into the membranes of the Brain, by which means the Brain is as it was in a Moment oppressed and drowned with a load and weight of blood so that the Nerves which derive their original from the same can convey no spiritts to supply either Animal, vital or Naturall faculties, whereupon, whoever is thus affected must necessarily die upon the spott, without either pulse, or Respiration: 'tis true, in a partiall Apoplectick paroxysm, such as Lethargick, Comatus, and the like affections of the Brain the persons affected do not only retain their breath and pulse, But may likewise open their eyes, give a rational answer, may, recover out of those fitts, and live some years after as was observable (if I mistake not) in the late Archbishop Tillotson, But if a third fitt attaques em, it proves mortall, as the Great Hippocrates wisely observed, and so it did in that renowned and learned prelate. But then in these and the like Cases I do suppose that neither the quantity off Blood which is extravasation (sic) the Brain is so great and ponderous, neither are the same vessells affected as in a total Apoplexy, but rather some small Arterrolae or branches of the greater Arteries, whereby, neither breath extravasation of blood being so little and considerable, that by phlebotomy duly administered, cupping glasses applied and the patients affected may be as happily cured, as when the blood is extravasated in Quinsies, pleurisies, Contusions and other Inflammatory diseases; But in total Apoplectick paroxysms (as I before observed) the patient is as it was planet struck or knocked down by a Club, or Butchers Ax, never more to move hand or foot after.

Your humble servant, CHARLES GOODALL.

The next and last letter[54] shows Goodall's great admiration for his 'father' in medicine, Thomas Sydenham. It was written five years before he came to preside over the College he had served so well.

Charterhouse, March 8th, 1703: Good Doctor, I fully purpose to publish some posthumous Works of my father and your good friend Doctor Sydenham, upon this account I waited upon his son to request him to supply me with what memoirs his father left.

He told me that what he had were put into your hands, and that if you pleased he should be very willing they should be printed by me. This is therefore to request you to let me know whether you are willing to part with them that I may doe a right to the Author now dead, as I honoured him whilst living.

I should take it a favour if you please to call upon me in a few days or appoint at what place wee may meet which will be a kindness owned by, Your faithfull freind & servant,

CHARLES GOODALL.

54 British Museum, MS Sloane 4039, f. 253.

During the early years of the eighteenth century three of these actors faded away from the medical scene. Millington died in January 1703/4 from chronic pyelonephritis, and a year later Locke died from congestive heart failure secondary to chronic bronchitis and emphysema. Eight years later Goodall died in office, leaving only Sloane, who lived on for over forty years, steadily accumulating more honours, wealth, and specimens for his vast collection. He was made a baronet in 1716; three years later he became President of the College of Physicians, and in 1727 succeeded Sir Isaac Newton as President of the Royal Society. He bought the Manor of Chelsea in 1740, where he died 13 years later at the age of 92, his library and large natural historical collection later forming the nucleus of the British Museum.

These letters, written by the least famous of these five physicians may, like thin filaments of fibrin, serve to coagulate a few particles of the past, so that the relations between them might be demonstrated with all the interconnecting strands of gratitude, high ambition, fulsome praise, and commonplace trivialities.

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Dr. Brocklesby of London (1722-1797)

An 18th-Century Physician and Reformer

WILLIAM S. CURRAN*

"I remember Dr. Brocklesby in London, a well-powdered, full and very respectable man. I thought he had a good share of the suaviter in modo."[1]

RICHARD BROCKLESBY was one of the outstanding physicians of late eighteenth-century London. Yet the main reason that his name survives at all from that colorful period is his association with the deathbed of Samuel Johnson. There was much more to him than that. He was doctor and friend to Edmund Burke, John Wilkes, and the third Duke of Richmond, and through them developed an interest in politics and social reform so intense as to be called "eccentric."[2] His companionability was famous. Boswell wrote of "his flow of spirits, just supplied by an active bustling through life."[3] On another occasion he added approvingly that "the doctor's reading, and knowledge of life, and good spirits supply him with a never-failing source of conversation."[4] Finally, he made significant contributions to medicine and public health and had an original, inquiring mind.

No good description of him survives. His formal portrait by Copley has been lost[5] and an indifferent engraving by Gridley published in 1798 shows a middle-aged man, stout and homely, but wearing an expression of considerable complacency. The sketch by Dance done in 1793 is more flattering, but by then Brocklesby was an old man.

Standard references[6-9] and previous articles in medical and

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1 Atkinson, J. *Medical bibliography, A and B.* London, 1834, p. 42.

2 Jeaffreson, J. C. *A book about doctors.* London, 1860, p. 7.

3 *Boswell papers.* New Haven, Conn., 1933. 18 vols, vol. XV, p. 118.

4 Hill, G. B., Ed. Boswell's *Life of Johnson,* including Boswell's *Journal of a tour to the Hebrides* and Johnson's *Diary of a journey into North Wales.* 6 vols., vol. IV, p. 203.

5 My best information (from a descendant of Thomas Young) is that the original Copley portrait was destroyed in Bristol during World War II.

6 Atkinson, *op. cit.* (n.1).

7 *Dictionary of national biography.* London, 1886, vol. 6, pp. 374-375.

8 Munk, W. *Roll of the Royal College of Physicians of London.* London, 1878, 3 vols., vol. 2, pp. 201-204.

9 Ree's *Cyclopaedia.* London, 1819, vol. 5.

historical journals[10–12] give a good outline of his career. He was the descendant of the Irish branch of an old Lincolnshire family, the name being recorded in the Domesday book. Records in the Friends Meeting House in Dublin establish that his forebears were Quakers emigrating from England about 1670, presumably to escape persecution. Richard was born in 1722 in Minehead, Somerset, while his Mother was visiting her English relatives there, but soon returned to Cork, where he spent his early years. In 1734 he was sent to Ballitore, a Quaker school in County Kildare highly regarded all over Britain. The year before he was graduated (1741)[13] Edmund Burke arrived as a new student, and this was the beginning of a long friendship. Late in 1741 Brocklesby went on to Edinburgh to study medicine. Here he was an early member of the illustrious Medical Society.[14] But instead of completing the course there, he transferred to Leyden in November 1743. Edinburgh was just entering its golden age, and Leyden had passed its peak with the death of the great Boerhaave, but there were advantages just then in a Leyden M.D. The College of Physicians in London was making it difficult for any Edinburgh graduate to practise in London, a manifestation of the anti-Scottish feeling that reached its peak in the summer of 1745 with the invasion of Bonnie Prince Charlie. It was during this troubled time that Brocklesby defended his thesis *De Saliva Sana et Morbosa* and received his degree. His stay in Holland was to be of considerable value to him for other reasons. According to a contemporary diarist[15] there was "a perfect colony" of English and Scottish students at Leyden during this period. Among them were the future politicians John Wilkes and Charles Townshend, and the Doctors John Gregory, Mark Akenside, and Thomas Dickson, all of whom were destined to make their mark.[16]

Setting up his first practice on Broad Street in London, Brocklesby encountered those difficulties that made Johnson remark (of the socially inept Akenside) that "a physician in a

10 Warbasse, J. P. Doctors of Samuel Johnson and his court. *Med. Lib. Hist. J.*, 1907, 5, Nos. 2 & 4.

11 Howell, H. A. L. Richard Brocklesby (M.D., F.R.C.P., F.R.S.) Physician to the Forces and afterward Physician-General to the Ordinance. *J. roy. Army med. Cps.*, 1911, *17*, 115-122.

12 Bishop, T. H. Richard Brocklesby (1722-97). *Med. Bookman*, 1947, *1*.

13 Leadbeater, Mary. *Leadbeater papers—Annals of Ballitore*. London, 1862.

14 Gray, J. *History of the Royal Medical Society of Edinburgh 1737-1937*. Edinburgh, 1952.

15 *Autobiography of the Rev. Dr. Alexander Carlyle of Inveresk*. Edinburgh and London, 1932.

16 Innes-Smith, R. W., *English-speaking students at Leyden*. London, 1932.

great city seems to be a mere plaything of fortune." Even the great Heberden was on the verge of returning to the country in despair of ever achieving financial success. It was necessary to have some special talent to attract patients from the apothecaries and flourishing quacks. Fothergill was known by his "thee" and "thou," Radcliffe by his bullying manner. Brocklesby made use of his European experiences. In 1746 he published a book on what might seem a strange topic for a physician, *An Essay Concerning the Mortality prevailing among Horned Cattle in several parts, of Europe and chiefly about London.* The epidemic was a matter of great current interest, and Brocklesby had had a chance to make some observations in Holland where it had passed on its way to England from the Middle East. The book was dedicated to Richard Mead, at that time the most famous physician in London. But aside from the possibility that it might have been written to attract attention and goodwill in the right quarters, it does show an early interest in problems of public health and the spread of infection.

There were only a few channels available in that day for the publication of original investigations addressed to the attention of other scientists. The Royal Society was one, and in April, 1746 Brocklesby submitted a letter to the President entitled "On the Production of Salts."[17] Here he described experiments he had performed to establish a common basis for alkaline, vitriolic and nitrous salts, and speculated (rather hazily) on their origin. In January, 1747, a second letter from Brocklesby was read to the Society, about "An Indian Poison." One cannot help being impressed with his careful description of the effects of this substance (sent to him by a friend in Paris) on a cat, dog, and bird, including autopsy findings. His third letter, dated 17 March 1747, was "On a Poisonous root lately found in a parcel of gentian root." It had been eaten by a number of people in the Broad Street neighborhood with resulting blindness, paralysis, and a high mortality. Brocklesby had located the source and attempted a chemical analysis.

In February 1747 Brocklesby was proposed for membership in the Royal Society by Doctor Mead. He was elected later that month, being described in the minutes as "a gentleman well versed in natural, mathematickal and medical knowledge."[18]

17 MS of the Royal Society. *Letters and Papers*, vol. 10a, no. 742. Quoted with the kind permission of the Society.

18 MS Minutes of the Royal Society, p. 343. Quoted with the kind permission of the Society.

It would be unheard of nowadays for membership to come so easily to a twenty-five-year-old, but the Society at that time was less exclusive. In January 1749 John Wilkes was elected on Brocklesby's recommendation and described as "a gentleman of distinction, merit and learning."

In 1749 another book came from Brocklesby's prolific pen. It was entitled *Reflections on Antient and Modern Musick with the Application to the Care of Disease*. The book contains a philosophical preamble alluding to the classical Aesculapian methods of music therapy which Brocklesby proposed should be revived. The rest of the book contains some interesting accounts of the various effects of music on emotion and body physiology.

His last letter in the records of the Royal Society is dated 19 June 1755.[19] In it Brocklesby reviewed the recent work of Albrecht Haller on nerve irritability and sought to confirm it by experiments of his own. Although, he said, "it did violence to my own temper" to hurt animals, he tested pain reactions on lambs which a neighboring butcher had marked for slaughter, remarking in his own defense that more cruelty could be seen on any day in the Smithfield Market. By stimulating skin and joint capsular ligaments he demonstrated, as had Haller, that the nerves transmitting pain were separate from those serving motor functions.

During the course of these years on Broad Street, he began to receive some encouraging professional recognition. He became a Licentiate of the Royal College of Physicians in 1751 and a Fellow in 1756. In 1754 he received a medical degree from Dublin and later that same year the coveted Cambridge M.D. In 1758 he was Gulstonian, and in 1760 Harveian, Orator for the College. Yet about this time a sudden restlessness must have seized him. He was thirty-six and unmarried. The Seven Years' War had started in 1757 and a British Expeditionary Force was in Germany supporting the Hanoverian ally, Prussia, against the common enemy, France. Brocklesby applied for and received a commission as Physician to the Army, and in 1758 was sent to the Continent.

His military service confirms that he was no longer a practising Quaker. As a matter of fact the records of the Friends Meeting House on Broad Street make no mention of his name, and one suspects some years before "the gaieties of life drew him from a path too strait for a young man of his vivacity."[20]

19 Royal Society, *op. cit.* (n. 17).

20 Savage, J. *History of Carhampton.* London, 1830, p. 310.

Brocklesby made as good use of his five years with the Army as he had of his other opportunities. It was here that he met his future patron, the Third Duke of Richmond, hero of the Battle of Minden and destined to become a force in liberal British politics. But even more important, the campaigns in Germany and his observations in the English camps were to provide the material for a book of considerable importance in military medical history. Ponderously called *Oeconomical and Medical Observations in two parts, from the year 1758 to the year 1763, inclusive, tending to the improvement of military hospitals and to the cure of Camp Diseases incident to Soldiers* (Fig. 1), it was published in 1764 after his return to civilian life. Brocklesby's intention in the book was "to amend or correct what I apprehend was imperfect and deserving a reformation in the medical treatment of soldiers." There was much to amend. He observed first of all, that "much of the miseries of War result from confusion and disorder—the latter may be heightened or surprisingly diminished in proportion to the neglect or provident attention of officers and others." Deliberate training and physical conditioning, avoiding "the misery of having nothing to do" (especially on the crowded transport ships) were strongly emphasized. In regard to shipboard diet, he seemed to recognize that an increased intake of fresh vegetables and "subacid" fruits was important. Although he shared the general inability to see the merits of the orange and lemon juice proposed by Lind in 1753, he did recommend cider, which Lind had declared second best.[21]

Without doubt his most important and original ideas concerned military hospitals. It is not quite fair to say that Brocklesby's book "is the first in which sound principles of hygiene were laid down for the Army."[22] Sir John Pringle, his fellow member in, and later President of, the Royal Society, had written his *Observations of the Diseases of the Army* in 1752, and had emphasized the devastating effects that crowding, dampness, and poor ventilation had on the spread of "putrid" diseases. Brocklesby is quick to acknowledge his debt to Pringle and modestly suggests that his own work might have value "as a more popular treatise on the same subject." But Brocklesby's grasp of the administrative aspects of hygiene was more complete than Pringle's. Certainly his methods were more original. In 1758 on the Isle of Wight he had

21 Bloomfield, A. L. *A bibliography of internal medicine. Selected diseases.* Chicago, University of Chicago Press, 1960, p. 281.

22 Howell, *op. cit.* (n. 11)

observed that more wounded men survived in hastily constructed sheds than in the filthy farm houses that were usually requisitioned as hospitals. Two years later in Surrey he managed to obtain permission from General Cornwallis to build some infirmaries that would imitate the advantage of the sheds. Selecting the "driest and most airy spots," and for the cost of ten guineas each, he constructed "occasional huts," each with a wooden frame supporting walls made of "wattles," and reinforced on the roof and weather side with extra straw. Each held forty patients and was heated by a stove. To deal with the vexing problem of sanitation, Brocklesby simply had the sandy floor and straw walls scraped clean every three or four days. According to him, there was a dramatic decline in mortality and morbidity among the patients handled in this way.

The second part of his book is an account of his experiences with various diseases. Of greatest interest is not his limited therapeutics, but the fact, to which he called attention, that at least three quarters of the illnesses requiring the doctor's attention were nonsurgical. Yet the care of soldiers was entrusted to surgeons almost entirely. He urged that physicians be encouraged to apply for Army commissions and that surgeons receive instructions in materia medica and hygiene. There is little evidence that this was done. Nevertheless, Brocklesby maintained a life-long interest in the Army, and in later years was appointed Physician-General to the Ordinance.

By the time that his book was published in 1764, Brocklesby had moved to a new house in the pleasant riverside neighborhood of Norfolk Street on the Strand. Here he was to live the rest of his bachelor life, an unmarried sister keeping house for him (he refers to her in a letter). The house number is known but the house is no longer in existence.[23] In time he became an exceedingly successful and prosperous practitioner. Although we cannot claim the stature of a Jenner or Hunter for him, Brocklesby's professional accomplishments were certainly above the ordinary. He was a member of Fothergill's Medical Society and contributed three papers, the most interesting being "The case of a lady laboring under a diabetes, attended with uncommon irregularities of the pulse and palpitations of the heart." From his description the patient is likely to have had ventricular extrasystoles, since she recovered coincident with his blistering, bleeding, and purges. Another paper applauded

[23] Philips, H. *The Thames about 1750.* London, 1955.

MILITARY HOSPITALS CONSIDERED.

I Preſume to beſpeak the attention of the public to the following Eſ-
ſays, however ſhort and defective from what I could wiſh them to be,
concerning the regimen of the health of ſoldiers in Great Britain, as well in
their encampments, as in military hoſ-
pitals; that the knowledge and re-
membrance of ſeveral hints and ob-
ſervations, may not be loſt and buried
in oblivion with thoſe Gentlemen who
have made them; but that the expe-
rience of our time may be rendered

 ſubſer-

Fig 1. Page from an interleaved copy of Brocklesby's *On Military Hospitals and Camp Diseases* with corrections for the second edition. (Courtesy of the Royal College of Physicians Library.)

Fig. 2. Detail from "The Death of the Earl of Chatham in the House of Lords" painted by John Singleton Copley (1775). Five figures in the center forefront, left to right, are: Lord Camden, Richard Brocklesby, Duke of Grafton, the Right Honourable William Pitt, and the Honourable Mr. James Pitt. (Courtesy of The Tate Gallery, London.)

Fig. 3. Black and red chalk drawing of Richard Brocklesby by John Singleton Copley. (Courtesy of The Metropolitan Museum, New York, Morris K. Jesup Fund, 1955.)

the virtue of Seltzer Water, Brocklesby claiming good results in puerpural fever diphtheria, and "miliary fever."

He seems never to have had a regular hospital connection. In 1751 he was appointed physician to the London Lying-In Hospital, but resigned after a year. In 1774 he was proposed by the College of Physicians for the post of physician to St. Bartholomew's, but was rejected in favor of one of the hospital's own candidates.[24] He was on the Board of Consultants to George Armstrong's Children's Dispensary, the first institution of its kind in Britain.

In spite of Brocklesby's busy practice, which always included some charity cases which he not only cared for but supported financially, he found time to pursue his political interests. These, together with the Johnsonian association, give us our clearest view of his personality. It is not certain when he first became involved in Whig politics, but as early as 1756 his paper on Nerve Irritability received a blistering attack in Tobias Smollett's *Critical Review*, a Tory periodical. Brocklesby was dismissed as "a person ambitious of distinguishing himself in the world of science without the talents requisite for that purpose. . . . hammering on the discoveries of other people. There is something very curious in sheltering ones reputation under the shade of a butcher's slaughter-house." The Tories' ire had been aroused when Brocklesby was mentioned as the source of some gossip about the Earl of Bute. It is clear that he was already thought of as being a member of the Wilkes clique.

John Wilkes, Brocklesby's friend since Leyden days, is a subject of perennial fascination. Possessed of an odd charm and ready wit, he also devoted himself with considerable courage to the struggle against the King's attempt to establish dictatorial powers. In 1763 he went so far as to attack George III directly in Issue No. 45 of his newspaper, the *North Briton*. He was brought to trial for libel but escaped punishment because of his parliamentary privilege as an M.P. The angry government and the "King's Friends" sought other ways to silence him. These were not hard to find. Wilkes was an opportunist and also thoroughly immoral. For the amusement of his friends in the "Medmenham Monks" he had written an obscene parody of Alexander Pope which he called an "Essay on Women." Prime Minister Bute's agents secured a copy and it was read aloud to a horrified Parliament. At the same time another M.P. named Samuel Martin was secretly incited to

[24] Moore, N. *A history of St. Bartholomew's Hospital.* London, 1918.

challenge Wilkes to a duel. In the resulting exchange of shots Wilkes was seriously wounded in the abdomen. Brocklesby was called on to attend him, and by his association with the now popular hero was catapulted into the limelight. He testified before Parliament that his patient was too ill to answer questions, and doubts were cast by the government on his professional competence. Charles Townshend (another Leyden alumnus) leapt to his defense, and when another opinion was suggested, Wilkes would not hear of it, emphasizing in a letter the "peculiar propriety" of Brocklesby's attendance in a gunshot-wound case. Horace Walpole wrote with amusement to a friend that for a time it almost seemed that Dr. Brocklesby was on trial rather than Wilkes. Shortly thereafter the latter escaped into exile, later writing to thank his physician "for the services he had done in restoring so good a friend of liberty."[25] Wilkes was to go on to even greater fame and finished his life in respectability, but in his collected correspondence there is no more mention of Brocklesby. It is likely Wilkes' immorality was distasteful to the ex-Quaker. Gradually Brocklesby's interest in social reform led him into association with sober, conscientious reformers like Granville Sharp, Cabel Lofft, and the radical publisher John Almon. In 1780 he was a founding member of the Society for Constitutional Reform, whose object was to give the public enough information so that a beginning could be made in improving the grossly unfair system of representation. He continued to attend the Duke of Richmond, who had become a leader in the battle for parliamentary reform. And he was a member of that Whig stronghold, Brooks's Club.

As a regular observer in Parliament, Brocklesby was a spectator in the House of Lords on the day in 1778 when the Earl of Chatham collapsed during a debate with Richmond over the latter's proposal to end the American War. Copley painted Brocklesby into his great canvas "The Death of the Earl of Chatham" (Figs. 2 and 3) pressing forward to render first aid. This constitutes what I believe to be the best likeness of Brocklesby available.

His long friendship with Edmund Burke undoubtedly had a great influence on his political thinking. Burke's collected letters first mention some "wild chat" of Brocklesby's in 1766, and the two men died within a short time of each other in 1797. In review-

25 Almon, J., Ed. *Memoirs of John Almon.* London, 1790.

ing their correspondence it is plain that Brocklesby lacked the light touch which came so easily to his friend. He was probably not amused when Burke hailed him on the street one day as "Dr. Rock" (a famous quack) and then went on to explain that Brockless-B "mathematically" equalled Rock. Yet it was to Burke that Brocklesby gave evidence of what friendship could mean. On 1 July 1788 he offered Burke £1000 as an advance bequest, adding that he intended to repeat the gift yearly until the chronically indebted statesman received due recognition from his country. When Burke demurred, Brocklesby pressed him to accept, writing that "unfavored as I have lived a long life, unnoticed professionally by any party of men, and although unknown at Court, I am rich enough to spare to virtue (what others waste on vice) and still have enough to live on."[26] The following day Burke wrote a grateful acceptance, referring to their friendship which had "started with a series of good offices on your part without any power of returning them on mine . . ." and expressing confidence that Brocklesby was one "who can never be capable of converting his kindness into a burden." Brocklesby followed Burke's political career closely, and when the latter became ill in his last years with what might have been cardiac symptoms, he wrote him in considerable detail about the best method of employing opium for relief.[27]

Most of the politicians with whom Brocklesby allied himself were opposed to the British policy of repression in America, as were his associates in social reform groups.[28] Two letters which he wrote to Benjamin Franklin have been preserved.[29] On 22 October 1779 Brocklesby apologized for "giving you the trouble of a letter in these miserable times . . . when your cause is so high and ours so low. . . ." (He may have been referring to the armed neutrality, which had raised American hopes.) On 12 March 1783 Brocklesby wrote again, mentioning the "late fatal and ingloriously unnatural contest."

The most dramatic view of Brocklesby the political enthusiast is to be found in a scurrilous play by Samuel Foote, *The Devil on*

26 Fitzwillian and Bourke, Eds. *Burke Correspondence*. London, 1844.

27 Brocklesby to Burke, 14 February 1797. In Fitzwilliam Collection, Sheffield Library, Sheffield, England.

28 Burke's attitude is well known. Richmond was even more outspokenly pro-American, while Wilkes was the London representative of the Sons of Liberty! Charles Townshend was an exception. As Chancellor of the Exchequer during Chatham's mental illness in 1766, he did much to make the Revolution inevitable.

29 Brocklesby to Franklin. American Philosophical Library. Quoted with the kind permission of the Society.

Two Sticks, written in 1768. Brocklesby is portrayed as "Dr. Squib" ("You can tell him by his shuffle"). In response to an inquiry as to whether Squib is employed on medical matters an apothecary cries "No! Lord help you! He is too taken up with the National Illness to attend to particular ills. Why he would quit the best patient in town to hunt after a political scent; and would rather have a whisper from a great man in the Court of Requests than £500 for attending him in a chronical case." This parody has been dismissed as entirely unfounded,[30] but in view of what we now know of Brocklesby, it is almost certainly only exaggerated. Jeaffreson reported, as further evidence of the doctor's "eccentricity," an anecdote about his visit to a sick servant in the Duke of Richmond's household. Becoming involved in a heated argument with the valet "on the fate of parties and the merits of ministers," he is said to have returned home without remembering to visit the patient![31]

This rather comic view of Brocklesby should not be construed to mean that he lacked a sense of the dignity of his calling. There are several accounts of a duel he fought (or almost fought) with one Dr. Elliott (later Sir John Elliott and a favorite of the Royal household). The cause of it was Brocklesby's outspoken criticism of what he considered to be unethical behavior on the part of Elliott toward a patient they had both attended.

Certainly if it were not for Samuel Johnson there would be little written about Brocklesby. Although the Great Cham had a number of doctors, Brocklesby was Johnson's principal attendant during his final illness. It is not known when the two men first met. Although they had many mutual friends and Johnson had a general fondness for physicians,[32] they would have been most incompatible in their political and religious views, Johnson being an anti-American, high Church Tory. It is in fact in a mildly disapproving way that Boswell on 14 April 1775 records Johnson as saying, "I know a man, formerly a Quaker, but now, I'm afraid, a Deist . . ."[33] Scholars generally agree that he is referring to Brocklesby.

In the early part of 1783, Johnson was looking for a new "physician-in-ordinary" to replace his old friend Dr. Lawrence who had become incapacitated. On March 30th of that year

30 Howell, *op. cit.* (n. 11)
31 Boswell Papers (n. 2), vol. VII, p. 80.
32 Warbasse, *op. cit.* (n. 10).
33 Hill, *op. cit.* (n. 4).

Boswell was sitting with a despondent Johnson in the latter's chambers when "Dr. Brocklesby came and roused us by that flow of spirits . . ." (his first mention of Brocklesby by name).[34] In June 1783, after his aphasic stroke, Johnson wrote to Mrs. Thrale that "I sent to Dr. Brocklesby, who is my neighbor . . . ,"[35] and later described the treatment of blistering and cantharides applications that he received from Brocklesby and Heberden. In the year and a half before Johnson's death in December 1784, the two men became close friends. Ample evidence of this can be found in the twenty letters which Brocklesby received from Johnson and later turned over to Boswell. The letters contain full descriptions of Johnson's symptoms resulting from his cardiorenal disease and emphysema. Together with the autopsy (which Brocklesby attended), they form a most interesting item of medical history. The only effective treatments available were squills (which have some strophanthin action), opium, and phlebotomy. Johnson (a tireless experimenter) tried others on his own, and Boswell and Brocklesby contacted the finest clinicians in Edinburgh for advice, but the dyspnea, orthopnea, wheezing, and edema progressed inexorably.

The letters also reveal the degree of emotional support that Johnson required from Brocklesby. He was a difficult patient, not only prone to self-treatment but to violent criticisms of his doctor's methods. He confessed that "sickness had made him a peevish selfish ungrateful snarling dog"[36] and that "Brocklesby will lay my death to disobedience and my taking 7 times as much squills as he advised."[37] In his anxiety and fear of death he quoted the lines from Macbeth,

> Canst thou not minister to a mind diseas'd;
> Pluck from the memory a rooted sorrow. . .

On that occasion Brocklesby could only give the answer of the physician in the play—"Therein the patient must minister to himself"—and Johnson was pleased by the literary exchange (as he was when the opportunity arose to catch Brocklesby in a misquotation of Juvenal!). But there seems little doubt that Brocklesby was able to do much in the way of kind and solicitous attention to make the last days easier. With his familiar generosity he offered

[34] *Ibid.*

[35] Chapman, R. W., Ed. *Letters of Samuel Johnson*, Oxford, 1952. 8 vols., vol. VIII.

[36] The Yale Edition of the Private Papers of James Boswell. Letter No. C 582. Quoted with the kind permission of the McGraw-Hill Book Company.

[37] *Ibid.*, Letter No. C 582.

quarters in his own house to Johnson as well as the financing of a trip to the continent. Perhaps there were times when Johnson felt overwhelmed. In a curious statement, Courtenay told Boswell that Johnson "trusted to Heberden. He would not let Brocklesby kill him with kindness."[38] Whatever the effect of the medical care, Johnson was able to face his final hours with fortitude, and upon being told by Brocklesby that "he could not, without a miracle, recover,"[39] he would take no more physic of any kind.

One cannot help being amused by Johnson's concern during these dismal days with Brocklesby's "speculative opinions about Christianity."[40] Sick as he was, he made strenuous attempts to convert Brocklesby from his deistic reliance on the light of Nature and Reason. In the Boswell Papers is a document dated 28 November 1784 in Brocklesby's handwriting, entitled "On the Importance of Christian Faith." We are told that he wrote it out to Johnson's dictation, and at the end was forced to his knees while Johnson offered up a fervent prayer for his salvation.[41] This missionary effort must have started more than a year earlier for on 3 February 1784 Brocklesby wrote Boswell that in spite of his "rude atheistical health," Johnson "almost persuaded me into what I never was before on conviction."[42] That he did not succeed, however, is shown by another letter to Boswell written on 27 December 1784, where Brocklesby says that Johnson's "views of Nature and of the Universe and of all the various objects to which contemplative philosophy invites an unfettered, speculative mind were narrow, partial and much confined."[43] But the exposure to eloquent conservatism was not without effect. In 1786 Brocklesby met his old friend and fellow Liberal Granville Sharp on the street. The latter noted sourly in his diary, "Met Dr. B—— who talked of Johnson in the highest terms. When I replied I thought he was likely to build arguments on false foundations and contrary to natural rights, he said 'Dr. Johnson thinks the garrulosity of the people about their rights did infinite harm to good government and morality.' Thus the quondam professed advocate for popular rights and liberty has swallowed the perverted notions of the pensioner and indiscriminately adopted his

38 Boswell Papers (n. 3), vol. VII, p. 80.
39 Private papers of Boswell (n. 36), Letter No. C 582.
40 Ibid., Letter No. C 580.
41 Hill, *op. cit.* (n. 4).
42 Private papers of Boswell (n. 36), Letter No. C 578.
43 *Ibid.*, Letter No. C 582.

groundless sophistry in favor of passive obedience, and in his own words, garrulosity."[44]

In the remaining years of his own life, Brocklesby maintained frequent contact with many members of the Johnson circle, partly through dinners at the various men's houses, and partly through continued meetings of the Essex Head Club which he and Johnson had foundeed in 1783. He continued to maintain a busy practice. In addition he devoted himself to the education of (indeed virtually adopted) his great-nephew Thomas Young, that remarkable genius who was to contribute so much to nineteenth century medicine, optics, and Egyptology. Our final impression of Brocklesby is through the eyes of his youthful ward as recorded by one of the latter's biographers — "inclined to be somewhat querulous in temper and exacting in claims to respect . . . although liberal in great things he was somewhat parsimonious in small."[45] A number of the letters to Young are preserved and contain much sound advice as well as useful observations.

Brocklesby's death on 11 December 1797 may well have been hastened by a trip he made to Beaconsfield to offer condolences to the widow of Edmund Burke, for he died on the night of his return to London. Young inherited the house on Norfolk Street and a share of the considerable fortune Brocklesby left to him and another nephew. He was buried in St. Clement Danes Church, but there is now not even a grave marker left to record the fact, the body being lost in one of the periodic upheavals that made it so difficult to locate the remains of John Hunter in the same church only a few years after his death. It is reassuring to know that Brocklesby will be remembered as the epitome of the wise and kindly physician for as many years as great eighteenth century literature is read.

44 Prince Hoare. *Memoirs of Granville Sharp.* London, 1820.
45 Peacock, George. *Life of Thomas Young, M.D., F.R.S.* London, 1855.

LE CHIRURGIEN DE CAMPAGNE (THE COUNTRY SURGEON)

An engraving after the painting by David Teniers the Younger (1610-90). New Haven, Yale Medical Library, Clements C. Fry Collection.

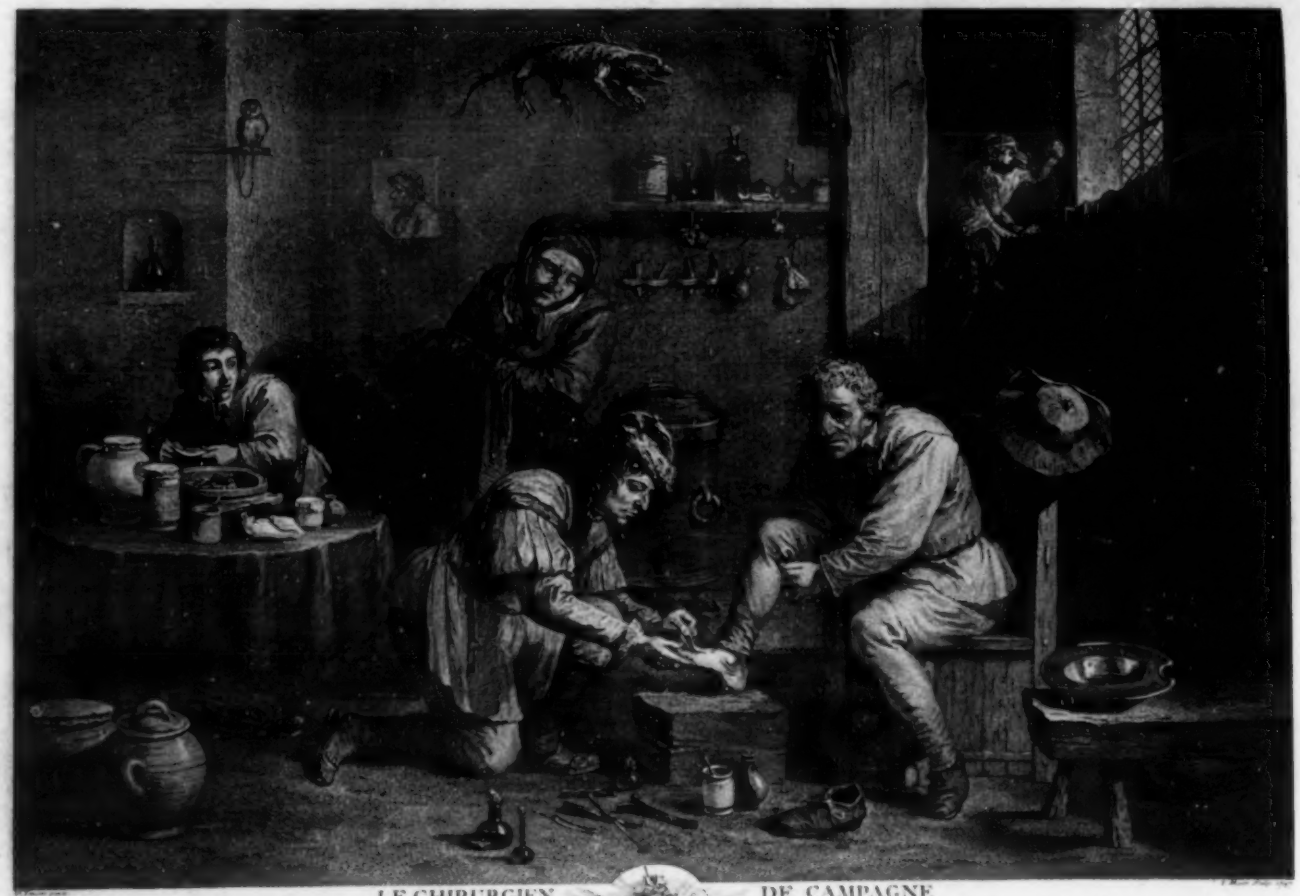
The country surgeon in his capacity of chiropodist is carefully removing a plaster from the foot of his plainly dressed patient who sits hunched over, resigned, supporting his leg in sling fashion with both arms. A woman, bread basket under arm and shawl over hands, watches intently. Off to the side the young apprentice heats a fresh plaster over some coals. His attention, like ours, is drawn to the therapy.

With a distinctly Teniers touch, several animals replay the action of the human drama. A frowning owl, with head cocked like that of the woman, perches on a stick with a confining chain round its neck. A stuffed iguana overlies and menaces the scene, its jaws open to the same acute angle with which the surgeon's hand holds the patient's foot; its claw legs recall the position of the surgeon's extremities. A smiling monkey atop the wood partition, with a ball in hand, offers a more playful imitation of the surgeon's work.

About the room are displayed objects which bespeak the country surgeon's other activities. On the back wall below the half-full bottles one makes out tweezers, scalpel, and perhaps a cupping device. On the bench rests a shaving dish, one edge indented for placing against the customer's neck. Close by the surgeon lies his razor, retractors, clamp, mortar and pestle, and two curious glass flasks. When not used simply as vehicles for the transport of topical medicines, they could be filled with water and made to function as magnifying glasses, or even as condensers to focus the available light.* The seventeenth century country practitioner was thus surgeon, physician, chiropodist, barber, and pharmacist.

J.M.P.

* Richer, P., *L'Art et la médecine*, p. 443.



LE CHIRURGIEN DE CAMPAGNE

Dedié à Monseigneur le Marquis

D'Argenson Ministre et Secrétaire d'Etat.

Gravé d'après le Tableau Original de Pierre Louis

Par son très humble et très obéissant Serviteur Tho. Major

Notes and Events

Edited by Dorothy M. Schullian*

A Sixth Possessor of the Gold-Headed Cane

It seems desirable to correct a discrepancy in statements regarding the number of physicians who possessed the Gold-Headed Cane. It will be recalled that the first to own it was John Radcliffe. Richard Mead received it from him, and it was then passed on to Anthony Askew. William Pitcairn was next to have it, and after him the Cane was the property of his nephew, David Pitcairn. Finally Matthew Baillie owned it, and on his death his widow gave it to the Royal College of Physicians.

The vicissitudes of The Gold-Headed Cane were described in the famous book of that title by William Macmichael, M.D., the first edition of which appeared in 1827 and the seventh in 1953.[1] It has five chapters, each bearing the name of a physician who carried the Cane. The fourth chapter, though entitled only "Pitcairn," deals clearly with both uncle and nephew. The title, however, is misleading to anyone who does not read the chapter entire. In fact, even in the preface to the seventh edition, though the mention of two Pitcairns is elsewhere clear, we read on page xix that the Cane "passed successively through the hands of Radcliffe, Mead, Askew, Pitcairn and Baillie during a period of nearly 150 years," and on page xiii that the scroll accompanying a new Cane award carries an inscription which states, "If this Gold-Headed Cane could speak it would say: 'I derive my being from The Cane, which was carried from 1689 to 1825 [*sic*] successively by five distinguished British physicians: Radcliffe, Mead, Askew, Pitcairn, and Baillie; and which now rests in the Hall of the Royal College of Physicians in London. Its history is recounted in a book by Macmichael.' "

We are not surprised, therefore, that books not wholly concerned with the Cane sometimes assign only five owners to it. Garrison,[2] Hone,[3] and

* History of Science Collections, Cornell University Libraries, Ithaca, New York.

1 Macmichael, W., *The gold-headed cane.*
1st edition: London, John Murray, 1827.
2nd edition: London, John Murray, 1828.
3rd edition: London, Longmans [and others], 1884. Edited by William Munk.
4th edition: New York, Paul B. Hoeber, 1915. With an introduction by Sir William Osler and a preface by Francis R. Packard.
5th edition: London, H. Kimpton, 1923. New edition by George C. Peachey.
6th edition: New York, Froben Press, 1932. Edited by Herbert Spencer Robinson.
7th edition: Springfield, Illinois, Charles C Thomas, 1953. With a foreword by James J. Waring and a preface by William J. Kerr.

2 Garrison, Fielding Hudson, *An introduction to the history of medicine,* 4th ed. Philadelphia, W. B. Saunders Company, 1929, p. 390.

3 Hone, Campbell R., *The life of Dr. John Radcliffe, 1652-1714.* London, Faber and Faber, 1950, p. 38.

Major,[4] for example, list only one Pitcairn, and Bettmann,[5] though he mentions six owners, furnishes a portrait of only one Pitcairn, who is clearly William.

I am grateful to L. M. Payne, Librarian of the Royal College of Physicians, for further suggestions as to how the confusion regarding the number of owners of the Cane originally arose and for his authoritative efforts to resolve it. His information reached me in the following letter of 19 December 1961 which he has graciously allowed me to publish:

It is, perhaps, not surprising that so many people regard the Cane to have been held by five rather than six physicians. In the first place, only five coats of arms are engraved on the handle, and in the second the description of the Gold-Headed Cane in the descriptive catalogue of the portraits etc. in the Royal College of Physicians (1926) lists only five owners. "Notice by the Editor" appearing in the first and second editions [of Macmichael] states that The Cane "had been successively carried by Drs. Radcliffe, Mead, Askew, Pitcairn and [Baillie]. The arms of these celebrated physicians are engraved on the head of the Cane, and they form the Vignettes of the five Chapters into which this little Volume is divided." Successive editions follow the text of the second rather than the first. The extra material included in the second edition occurs for the most part in the chapters on Mead and Pitcairn and that really gives the clue to the confusion. Osler, in his introduction to the fourth edition (1915) says "MacMichael does not tell us much about him [i.e. Pitcairn] and leaves us a little in doubt when he died, and whether or not his nephew, David, was one of the possessors of the Cane." In the first edition (1827, p. 134) we read "but in the interval that elapsed from the death of Dr. Askew, which happened in the year 1774, till I was bequeathed to the late Dr. Baillie, I was chiefly in the possession of Dr. David Pitcairn." In the second edition (1828, p. 183) we read ". . . Dr. Wm. Pitcairn, into whose hands I now was delivered . . ." and later (p. 205) "In 1784 he resigned the office of President, being succeeded by Sir George Baker; and in seven years afterwards died, when I was bequeathed to his nephew, Dr. David Pitcairn."

I think you will agree that it is now fairly easy to see how the confusion between five and six owners of the Cane arose. I suspect that the reference to five owners on the book jacket of the seventh edition may be due to the fact that the notice by the editor to which I referred earlier is reproduced in the text of this edition.

I may add that the entry in our catalogue of portraits has been duly corrected, certainly since the error was again brought to light when an exhibition on The Gold-Headed Cane was arranged in the library some years ago.

JEROME M. SCHNECK

[4] Major, Ralph H., *A history of medicine.* Springfield, Illinois, Charles C Thomas, 1954, 2 vols. Vol. 1, p. 563, vol. 2, p. 702.

[5] Bettmann, Otto, *A pictorial history of medicine.* Springfield, Illinois, Charles C Thomas, 1956, p. 191.

Some Answers to What Was Kappa Lambda?

Forty years ago I raised the question "What Was Kappa Lambda?" (*Ann. Med. Hist.*, 1922, *4*, 192-206). After a recent delightful visit to Lexington, Kentucky, where I had the pleasure of exchanging ideas with that interesting "Sunday Service" group, Doctors John S. Chambers, Francis M. Massie, and Coleman C. Johnston, I have some partial answers.

Taking his cue both from the efforts of Thomas Percival (1740-1804) in trying to develop some intra-professional courtesy and decorum in the English medical groups and from the example set by the Phi Beta Kappa Honorary Society of William and Mary College in Virginia, Dr. Samuel Brown (1769-1830) thought he might improve the standards and ideals of medical education and medical practice in the burgeoning frontiers of the United States by organizing a secret society of intellectual medical leaders who might set an example to the rest of the profession.

This society was first called the Kappa Lambda Society of Hippocrates and was organized at the beginning of the nineteenth century in Lexington, Kentucky, at Transylvania University. It is suggested by Dr. Francis Massie that the Greek letter name of the fraternity was *Kalos Logos,* meaning noble thought or expression. This would be in accord with the high idealism expected of the members. The motto of the organization was "Non doctior, sed meliore imbutus doctrina."

In the reorganization of the School of Medicine at Transylvania University about 1819, the society apparently flourished, and members were authorized to establish similar societies at their respective places of residence "subject to restrictions prescribed by our constitution." Such societies were established in eastern cities, certainly in Philadelphia and New York, and probably in Baltimore and Charleston as well. In New York the organization was apparently called the "Kappa Lambda Society of Aesculapius," while in Philadelphia it was termed the "Kappa Lambda Association of the United States." The Philadelphia group issued the *North American Medical and Surgical Journal,* which in 1828 acknowledged on its title-page that it was published by this association.

I know nothing more about the decline of the organization than I originally reported. Many records and memorabilia of the organization are preserved under the care of Roemol Henry, the librarian of Transylvania University in Lexington. Much of this relates to that "persevering idealist," Daniel Drake (1785-1852), who seems to have been greatly influenced by Samuel Brown.

It would seem sentimentally appropriate to revive the Kappa Lambda Society of Hippocrates as some kind of an honor society for the purpose of preserving and extending the high standards and ideals of medical education and medical practice. This might be an appropriate undertaking in the splendid new College of Medicine at the University of Kentucky, which has now been established in Lexington.

Chauncey D. Leake

Renaissance Editions of Galen

Since 1955 this department has tried to mention twice a year in its section "Historical Gleanings" some of the articles important to medical history which are published in non-medical journals and which might not ordinarily be seen by medical historians. One appeared in the *Journal of the Warburg and Courtauld Institutes,* 1961, *24,* 230-305 which should have special notice here. With it Richard J. Durling provides "A Chronological Census of Renaissance Editions and Translations of Galen" which corrects and supplements the commonly used bibliography in the first volume of Kühn's edition of Galen and which will be valuable not only to students of Galen but also to historians of printing in the fifteenth and sixteenth centuries.

The list of 660 editions and translations, with library locations for each, follows an historical sketch of 15 pages which is rich in documentation. A separate listing is furnished for the apocryphal *Recettario.* Use of the primary list will be immensely facilitated by the analytical index arranged alphabetically by 160 titles, by the index of translators, and by the topographical index of printers and publishers.

The paper is an expansion of Mr. Durling's unpublished thesis submitted in 1959 in partial requirement for the University of London Diploma in Librarianship. On Galen's importance even after the year 1543 Mr. Durling cites the fact adduced by Gnudi and Webster, after Dallari, that his was the only text permitted in the teaching of surgery at the University of Bologna from 1586, when a change in textbooks occurred, until late in the eighteenth century.

Ophthalmology in Vienna

In celebration of one hundred and fifty years of ophthalmology in Vienna the Institut für Geschichte der Medizin at the University of Vienna held an exhibition during the month of June 1962 which emphasized the developments in that field from the founding of the University clinic in 1812 to the present day. Vienna holds an eminent place in the progress of ophthalmology which is immediately demonstrated by such names as Georg Joseph Beer, Friedrich Jaeger von Jaxtthal, Ferdinand von Arlt, Ernst Fuchs, Maximilian Salzmann, and Karl David Lindner. A catalogue of 33 pages and 4 plates, with introduction by Erna Lesky, was prepared for the exhibition. Already in the first half of the nineteenth century Vienna was a center of training for American ophthalmologists.

One notes that the first room of the exhibition area has been designated the Wellcome Room. It is pleasant to record that through a gift of the Wellcome Trust of London work in the Institute's library will be continued; holdings of the Josephs-Akademie will be catalogued and a restoration of the museum undertaken.

In Search of Correspondence of The Honourable Robert Boyle (1627-1691)

Dr. R. E. W. Maddison, who has written many articles about Robert Boyle, has been awarded a Leverhulme Research Fellowship for the purpose of producing an annotated edition of the Boyle correspondence. He wishes to know if there are letters *to or from* Boyle that have not come to his notice and will be glad to receive information about any items not listed in his Tentative Index (*Notes and Records of the Royal Society*, 1958, *13*, 128-201). His address is 2 Alderney Avenue, Heston, Middlesex, England.

Edition of Malpighi's Correspondence

Howard B. Adelmann, Professor of Histology and Embryology at Cornell University, Ithaca, New York, has begun work on a complete edition of all the letters written by and to Marcello Malpighi. He would be grateful for information concerning any such letters in private hands or in libraries (except for the libraries of Bologna and the Royal Society). He is prepared to defray the cost of photographing manuscripts and would of course return promptly any original material sent to him for photographing in Ithaca.

Second Award of Maccabaean Prize and Medal

The second Maccabaean Prize and Medal has been awarded to Mr. Robert W. Shapiro for his essay on "The Life and Work of James Currie." This annual prize, which is endowed by The Maccabaeans and awarded by the Faculty of the History of Medicine and Pharmacy of the Worshipful Society of Apothecaries, consists of a specially designed bronze medal and a money prize of 25 guineas. The competition is open to anyone under 30 years of age, and the prize is awarded for the best original essay on any aspect of the history of medicine or pharmacy.

The prize was presented to Mr. Shapiro by the Chairman of the Faculty, Dr. W. S. C. Copeman, at the Osler Lecture at Apothecaries' Hall on Wednesday, 18 April, before an audience of students and members of the Faculty. Mr. Shapiro is a student at Yale University School of Medicine, where students are encouraged to interrupt their formal studies for a year of research—usually outside the United States. He has been spending a year in England carrying out research into the life and activities of James Currie (1756-1805), an English physician who lived for a time in the American colonies; he was a well-known literary critic and edited the poems of Robert Burns. The information which Mr. Shapiro collected during his stay in England provided the material for the prize-winning essay. He returned to the United States in September to continue his

clinical studies. The prize essay is to be published in full in a forthcoming issue of *Medical History*.

JEAN WOODWARD

Seventh Annual Dexter Award

In September the American Chemical Society presented to Professor Henry M. Leicester, head of the Department of Physiological Sciences at the College of Physicians and Surgeons in San Francisco, its seventh annual Dexter Award for noteworthy contributions to the advancement of the history of chemistry. The award was established in 1956 by the Dexter Chemical Corporation. Professor Leicester has written on biochemistry of the teeth, on outstanding Russian chemists, and on the history of chemistry in Russia before 1900; he has also published a source book on chemistry, 1400 to 1900, and a work on the historical background of chemistry. He is founder and at present editor-in-chief of *Chymia*.

Museum of the History of Medicine, University of the Witwatersrand

On 2 April 1962 a Museum of the History of Medicine was inaugurated at the University of the Witwatersrand, Johannesburg, under the auspices of The Medical Graduates Association. The intention is to preserve here all material which illustrates the history of medicine in general and its development in South Africa in particular. Appropriate donations from members of the medical or allied professions or from the public may be made to Dr. Cyril Adler, 701 Ingram's Corner, Twist Street, Hospital Hill, Johannesburg.

The inaugural ceremonies included an address by Professor W. G. Sutton, Vice-Chancellor and Principal of the University, entitled "A South African Museum of the History of Medicine" and a lecture, "Mine Eyes Have Seen," by Major-General Alexander J. Orenstein, who worked with William Crawford Gorgas in Panama. The proceedings have been published in *Medical Proceedings*, 1962, *8*, pages 123-127 and 232-237.

American Association for the History of Medicine

The Thirty-Sixth Annual Meeting of the American Association for the History of Medicine will be held in Boston, 2-4 May 1963. All who wish to present papers are requested to send titles and brief abstracts (less than 200 words) to the chairman of the program committee, Dr. Lester S. King, 836 Wellington Avenue, Chicago 14, Illinois. Titles must be submitted before 1 February 1963.

Book Reviews

DENYS HAY. *The Italian Renaissance in its Historical Background.* (The Wiles Lectures Given at the Queen's University, Belfast, 1960.) Cambridge University Press, 1961. xii, 217 pp., 24 illus. $5.50.

Reviewed by HARCOURT BROWN, *Professor of French Language and Literature, Brown University, Providence, R. I.*

ALTHOUGH this book contributes very little to the history of medicine and allied science, it offers a lively and up-to-date review of the present state of knowledge concerning the Italian Renaissance in many of its aspects. Professor Hay, who holds the chair in Medieval History at Edinburgh, asks us (page 24) to admit that "before genuinely modern times, science was singularly uninfluential," and to accept his view that in the history of this period the sciences were so nearly non-existent that he could safely omit them from consideration.

The book, however, has many merits; the author directs his efforts to provoking "an unbiased and fresh appraisal" of a phase in history which has "suffered from traditional and stereotyped treatment . . . by being dealt with as static and solid." This involves an attempt to offer a very nearly total view; while both Burckhardt and J. A. Symonds had done this long ago, the exploration of sources has gone far beyond their work, and more modern historians have learned to "accommodate change, and see that concepts are servants, not masters." Professor Hay makes no claim to offer a circumstantial history of the period; rather he seeks a synthesis, a general view, based on the scholarly work of the last fifty years or more, in which he can present the outward aspects of the period in broad outlines, with sharp awareness of the useful and significant details, referring in a wealth of footnotes to the innumerable articles and books on which his fresh insights are based. It all makes a convenient book for the historian of the sciences to have at hand; economic and political conditions may at any moment be relevant to the history of science or technology, and Dr. Hay's abundant documentation lists innumerable titles in several languages.

Even if they are not important in his view of the period, Dr. Hay is aware of the sciences; he assures us (page 143) that the "significant figures of the Renaissance were neither for nor against physical science. . . Indifferent to this particular aspect of traditional philosophy as to the philosophy of the old kind altogether," their highest thinking would be a love of wisdom, "different from that of the mediaeval university," and even less relevant to the mathematicians and physicists and chemists. From this general rejection Dr. Hay excludes optics and perspective, related disciplines advanced empirically in Italy and Flanders, and which received theoretical development by Brunelleschi and Alberti.

Professor Hay ranges widely in his two hundred pages, discussing the concept of Italy and its first appearance in western consciousness, as well as its influence on the writings of many authors, and the perspective given to all Italian historiography by awareness of the unity, geographical if not always ethnic, of the peninsula. In the 48 pages of Chapter V, on Renaissance Values, and in later pages on the reception of the Renaissance in Italy and the North, we are given an admirably concise and elegant review of questions of wide importance. Consultation of the book is made easy by an index, and a series of well-chosen plates offer a rapid review of the kind of object, from a page of English signatures of 1534 to an air view of the oval Piazza del Mercato at Lucca, with assorted paintings, sculptures, and architectural details in between, which modern thinking regards as essential in discussing the Renaissance today.

LUIGI GEDDA. *Twins in History and Science.* Springfield, Illinois, Charles C Thomas, 1961. viii, 240 pp., 171 illus. $12.50.

Reviewed by JOHN D. RAINER, *Associate Research Scientist and Assistant Clinical Professor of Psychiatry, Columbia University, New York.*

THE recent renewal of interest in twin studies in various medical specialties makes the publication of this first volume of a contemplated two-volume American edition of Luigi Gedda's monumental *Studio dei Gemelli* a particularly timely event. To twin researchers throughout the world, the author is known as professor of medical genetics at Rome University and the director of the Gregor Mendel Institute. Twins have been his primary interest for many years, and he has pursued his subject in mythology and the arts, in world and scientific history, in plant and animal life, and in the demographic, genetic, embryological, and anatomical aspects of human biology.

Among the most productive uses of twins in research are those illuminating the interaction of genetic and experiential factors in human development. On pages 98 and 99 of this volume, the author succinctly evaluates the various facets of the twin study method as used in human genetics. The approaches listed include the collection of representative series of twins (comparison of data on monozygotic twins and on dizygotic twins, the environment starting out the same in each case), and the cotwin control method (comparison of data on monozygotic twins reared under different conditions—a much rarer experiment of Nature than the previous one), with such special applications as the analysis of dissimilar pairs in the investigation of quantitative and qualitative variations in the phenotypical manifestation of a gene-specific trait (expressivity).

Following several chapters which deal with the etiology and embryology of twinning, the survey of clinical twin data in this volume is limited to anatomical characteristics. In this area the method of research "calls for a

comparison of two twin partners with a complex interplay of endogenous or exogenous factors responsible for their various degrees of similarities." In the material of the second volume, still to appear in English, psychological characteristics as well as detailed case reports on physical and mental illnesses are to be considered along with the complexities of methodology.

As an historian and humanist, Professor Gedda is well aware of the enjoyment to be had and the insights to be gained by considering the cultural significance through the ages of so universal, yet so impressive, an event as the birth of twins. Legends about twins in Persian, Indian, Greek, Roman, and North American mythology with corresponding superstitions and folk practices portray both the favor and the awe in which such pairs have been held. The positive and negative attitudes toward them, respectively reflected by their deification or their abandonment by their progenitors, are themes whose psychological validity is being rediscovered today as attention is given to problems of identification and self-image in twins.

In reviewing the historical development of the scientific study of twins, the author presents the etiological opinions of Hippocrates ("division of the sperm into two parts, with each part penetrating one of the two uterine horns"), Empedocles ("an excess of sperm"), Democritus ("sperm emitted at different times"), Aristotle (who cautiously indicated the causes might be multiple), and Galen ("excess heat in the uterus might split the sperm"). A comment by Cicero (*De divinatione II*) foreshadows the contemporary viewpoint that genetic predisposition and life circumstances interact in determining man's fate. As to twins in relation to astrology, Cicero writes: "Even Diogenes, the Stoic, admits certain things. For example, that the stars can only predict the temperament a man will have or what he will best succeed in. He declares that the stars have no power to foretell anything else, and that though the appearance of twins is similar, their lives and living conditions are generally different. Procles and Euristenes, kings of the Spartans, were twins but they did not live for the same number of years. Procles died a year before, though he greatly surpassed his brother in the glory of his feats."

The value of the historical section of the volume, as indeed of the entire book, is enhanced by its illustrations, old and new, black-white and color. It would seem to be regrettable, however, that some of the representations of twins in painting and sculpture which were included in the Italian edition had to be omitted here. Be that as it may, the volume contains many elaborate tables and gives evidence throughout of careful translation and precise editing. Beyond doubt, it will become a standard reference book which at the same time traces the worldwide development of twin research.

To the medical research worker in all specialties and to any reader interested in the history of embryology, this first volume of Professor Gedda's—*magnum opus* will be a most absorbing compendium.

KENNETH J. FRANKLIN. *William Harvey Englishman.* London, Macgibbon and Kee, 1961. 151 pp., 9 illus. 18s net.

Reviewed by C. D. O'MALLEY, *Professor of Medical History, University of California Medical Center, Los Angeles.*

KENNETH J. FRANKLIN, Professor Emeritus of Physiology in the University of London, has long been recognized as an authority on the physiology and the history of the physiology of the cardiovascular system. For many years he has had an intense interest in William Harvey and has recently provided us with definitive translations of *De motu cordis* (1957) and *De circulatione sanguinis* (1958). His present study of William Harvey is perhaps to be considered as the capstone to these translations since, although a biographical study of Harvey's career, it is primarily concerned with his work on the circulation of the blood. It is a single, long essay without division into chapters, an erudite sketch which immediately displays its author's profound knowledge of his subject. Written in a highly personal manner with frequent asides within the body of the text, it permits us to appreciate the author's intense concern with his subject and his mastery of its every aspect. Nevertheless, a full appreciation of this study requires some preliminary background knowledge on the part of the reader since Professor Franklin has not included elementary explanatory details, although he has included sixteen and a half pages of bibliography. Hence the perplexed beginner or, for that matter, the reader who wishes to enter still further into the problems of Harvey's career has a valuable guide, and it is to be hoped that the author's very obvious concern and enthusiasm for his subject may arouse the interest of those less familiar with the intricacies of Harvey's career and lead them to seek further knowledge of this remarkably fascinating seventeenth century Englishman.

Harvey is considered not only as a man of his own epoch but also as the heir of earlier ages, and in consequence the essay opens with a consideration of contributions to cardiovascular physiology from the classical period down to the period of the recognition of the pulmonary transit of the blood and the work on the venous valves in the sixteenth century. Professor Franklin suggests in fact that Harvey may have evolved a theory of the circulation of the blood while attending Fabricius' lectures at Padua and on his return to England sought through his researches to determine the validity of his theory. Such would be an explanation of Boyle's report of his famous conversation with Harvey, although, of course, any suggestion of such a flash of intuition is not meant to deny the significant contribution of Harvey's predecessors or his own years of laborious research after his return from Padua.

The details of Harvey's life with its interesting and even spectacular episodes are presented in chronological sequence, interrupted occasionally, as in the year 1628, for consideration of *De motu cordis* which is discussed chapter by chapter in a thorough and valuable analysis. Not very much attention is paid to the work on embryology, but perhaps we may look forward to a later consideration of this subject in conjunction with a translation of *De generatione animalium*. The interest of the book, as mentioned above, is focused on the problem of the circulation, and since Harvey's final years coincided with the growing influence of *De motu cordis*, attention is directed to Harvey's status in the world of science and his relations with proponents and opponents of his famous thesis.

There is a pleasant dedication to Professor Robert Janker and a brief foreword by Mr. A. Dickson Wright.

LOUIS BAKELANTS. *Préface d'André Vésale à ses Livres sur l'Anatomie suivie d'une Lettre à Jean Oporinus, son Imprimeur*. Bruxelles, Éditions Arsia, 1961. 87 pp.

Reviewed by C. D. O'MALLEY, *Professor of Medical History, University of California Medical Center, Los Angeles.*

THE dedicatory preface with which Vesalius offered his celebrated anatomical study, *De humani corporis fabrica*, to Emperor Charles V has long and justly been recognized as a remarkable document by reason of its autobiographical content, criticism of then common methods of teaching anatomy, and Vesalius' declared rebellion against them. In addition to this preface, the introductory matter of the *Fabrica* contains a second noteworthy document, Vesalius' letter to his publisher Oporinus in which the dispatch of the woodblocks for the illustrations is noted, directions for their arrangement relative to the text, and a diatribe against plagiarists, particularly those who had published unauthorized editions of the author's *Tabulae anatomicae*. The booklet under consideration contains a French translation of both preface and letter with the Latin text on the facing pages.

Unfortunately, however, the Latin text employed and translated is that of the revised edition of the *Fabrica* published in 1555, prepared a good many years after the events described and modified to suit the new condition of the author, then a successful and wealthy imperial physician and soon to become a gentleman. It is true that the translator supplies the variant readings of the 1543 text at the foot of each page, but this is surely a reversal of the normal procedure. Within the framework of this general criticism the translations are creditable, although this makes it even more regrettable that the translator's talents were not primarily applied to the original edition of the *Fabrica*.

There are notes explanatory of certain words and phrases in the preface and in the letter to Oporinus, although they provide nothing hitherto un-

known and a few things which are fairly obvious; there is a brief concluding index. Facing the title-page is the illustration of the male figure from the so-called Adam and Eve figures of Vesalius' *Epitome,* hence bearing no direct relationship to the content of the translations. The typography is excellent, and the booklet will make a handsomely ornamental addition to any collection of Vesaliana.

C. D. O'MALLEY and F. K. RUSSELL. *David Edwardes Introduction to Anatomy, 1532.* Stanford, California, Stanford University Press, 1961. 64 pp. $2.75.

Reviewed by EDWIN CLARKE, *Visiting Associate Professor of the History of Medicine, Department of the History of Science and Medicine, Yale University.*

IT is well known that England lagged far behind other European countries in the development of human anatomy in the sixteenth century. In fact, just as the medical school at Edinburgh preceded the London schools in importance, so facilities for dissection were established in Edinburgh in 1506, thirty-six years before similar arrangements were available in London. Until a few years ago, it was thought that the earliest anatomical works published in England were the plagiarized Vesalius of "Geminus" in 1545 and Thomas Vicary's anatomical text of 1548, of which no copy is known to exist today, but which was probably a compilation from medieval sources. In fact, despite the progress of dissection elsewhere, it seemed unlikely that any original anatomical work had been produced in Britain during the sixteenth century.

However, there is in the British Museum a unique copy of a book by David Edwardes (or Edguardus in Latinized form) on anatomy published in London in 1532, and this is the first work written in England solely devoted to anatomy. Dr. C. D. O'Malley and Professor K. F. Russell now present a facsimile reprint of this work, together with a translation into English. It is, as its author admits, "indeed a slight work" of only about 1,650 words on 15 small pages and it comprises mainly Galenic anatomy with a few medieval additions. There are, however, one or two original contributions, one of which concerns the renal arteries and indicates that the author had dissected personally. The other deals with the olfactory nerve, which Edwards counts with the cranial nerves; Willis in 1664 is usually given the credit for discovery of this.

The text is preceded by an introduction which, although repetitive in parts, is otherwise excellent, and discusses in detail the state of anatomy in England before 1532 and during the rest of the sixteenth century. Despite the inferior typography and tight binding of the original, the facsimile reproduction is clear and the translation which follows it is accurate and adequate; footnotes to the latter explain anatomical terms.

This book is an important contribution to the history of anatomy and it is appropriate that it should be dedicated to the late Charles Singer who initially advised and encouraged the authors.

A. C. CORCORAN. *A Mirror up to Medicine.* Philadelphia, New York and Montreal, J. B. Lippincott Company, 1961. xv, 506 pp. $5.75 (U.S.A.), $6.00 (Canada).

Reviewed by LLOYD G. STEVENSON, *Professor of the History of Medicine, Faculty of Medicine, McGill University.*

THIS is an anthology which represents the world of medicine as seen by the physician and as seen by others, in all times and countries, or at least in many. Its more than 500 pages, of common paperback size, make up a compact, easily handled bedside book, great riches in a little room.

Professor Allan Nevins, who provides a Preface, may be wrong in supposing that nobody has essayed such a collection before but certainly this one has unique range, quality and flavour. Despite the space given to T. Browne, O. W. Holmes, and W. Osler (all of them one jump ahead of W. Shakespeare), a majority of the excerpts are fresh and alive. Dr. Corcoran reads Vaughan and Doughty as well as Burton and Cheyne, Campion and Williams as well as Donne and Bridges, Mencken as well as Montaigne. Continental Europe is here as well as England and America, East as well as West.

Room is found for more than snippets. Mencken, for example, is represented by that incomparable fable, "The Incomparable Physician." Dickens gets as many as half a dozen pages, but Thackeray and Trollope are not neglected. There are eighty-odd lines from Erasmus Darwin's *Temple of Nature.*

Notes and interpolations in many anthologies are either purely informative or purely impertinent. Dr. Corcoran provides whatever information is called for neatly and succinctly and spices his commentary with wit. The views of Erasmus Darwin on esthetics (love of the maternal breast accounting for the eye's delight in wavy lawns, bending woodlands, winding shores, etc.) draw from the editor the suggestion that "on this basis, the cubist art-form is a sequel to the introduction of the square nursing bottle." That a selection from the diary of Alexis Carrel is here translated for the first time, Dr. Corcoran accounts for thus: "His fascist leanings and previous retirement to France isolated him from a public that had read enthusiastically *Man the Unknown* with what understanding God knows and the Book of the Month Club may."

Altogether a delightful book. I have not yet read it all. I look forward with real pleasure to many more doses of Corcoran's capsules. Broussais on boredom is one of the unfamiliar selections but almost any other will serve equally well to combat it. There is a little ennui in *A Mirror.*

LEO M. ZIMMERMAN and ILZA VEITH. *Great Ideas in the History of Surgery*. Baltimore, The Williams and Wilkins Company, 1961. xii, 587 pp., 113 illust. $15.00.

Reviewed by KENNETH D. KEELE, President of the History of Medicine Section, Royal Society of Medicine, London.

HAVE the surgeons' contributions to the advancement of medicine received too little consideration by medical historians? Dr. Zimmerman and Dr. Veith emphatically say that this is so. "The story of the evolution of medicine," they hold, "has received considerable attention from both historians and physicians; that of surgery by contrast, very little." They assert that the surgeon's needs for a basic knowledge of anatomy, physiology, and pathology has resulted in surgeons themselves making fundamental contributions which have enriched medicine as a whole, and that this has not been sufficiently recognised.

In considering the contributions of the pioneers of surgery they do not limit themselves to matters of scientific discovery, but extend their demonstration to medical ethics and education. The aim of this book, therefore, is to explore the achievements of great surgeons of the past, and to demonstrate these to the surgeons of the present. They are not attempting a conventional history of surgery but are trying "to convey a feeling for the growth of surgery by presenting its leading personalities from the beginning of literary records to the present time."

This objective they have approached by a consistent plan. Each chapter concerns itself with a surgeon. It consists of an introductory "epigrammatic statement," a biographical sketch to provide orientation in time and space, and finally a verbatim extract from the writings of the selected surgeon.

Drs. Zimmerman and Veith have sought to demonstrate the ideas of surgeons rather in the same way as Henry Sigerist did the evolution of medicine through the medium of his carefully titled book *Great Doctors*. Counting some names twice, like Hippocrates, as both physicians and surgeons, we find Sigerist names 29 physicians, 16 surgeons (and 2 gynecologists), 8 pathologists, and 5 physiologists amongst his great doctors. Surgeons, it would seem, were not unduly neglected by this historian at any rate.

In medical history, however, there has been much more neglect of ideas than names, the simple reason for this being that it is so much easier to refer to a name than to grasp what it was that the man with the name thought and did. The authors of this book sensed this when they gave it the title, *Great Ideas in the History of Surgery*. It is in just this sphere that they have made such a useful contribution to surgical history. For example, the evolution of the pathological knowledge and management of hernia, from ancient times to the days of Bassini, is described in all its stages. The same may be said of such fundamental surgical procedures as amputation and the treatment of fractures. But to obtain this information

in continuity one has to use the index, for the arrangement of the text is, as has been said, in the chronological order of the lives of their subjects. The book is in fact presented as a gallery of great surgeons. Though this has many advantages, it has the disadvantage of making the reader search for the development of great ideas.

Each chapter is notable for its fluent style and for biographical character-drawing. The epigrammatic saying has nearly always been sensitively chosen to give the outlook of the man. The selected excerpts describing the surgeons' most notable pieces of work must often be very controversial; here indeed they are.

This method of presentation has involved a great deal of selection from a huge mass of facts. Sometimes this has led to disquieting errors of detail. One such is the reference to John Hunter's sister as Matthew Baillie's wife rather than his mother. Another is the reference to the date of Tagliacozzi's birth as both 1547 or 1549 even when citing Gnudi and Webster's title-page where it is stated as 1545. Unfortunately, there are also many typographical errors. Surely Cline not Clive is referred to on page 347 as a pupil of John Hunter? Yet "Baron Robert Clive" finds an entry even in the index. These accidents jar the reader's appreciation of the smooth charm with which these surgical sketches abound; sometimes they mar too the legends to the finely selected and reproduced illustrations.

This beautifully produced book is of course primarily addressed to surgeons. It provides a delightful source into which any surgeon interested in the history of his own specialty can pleasantly delve. And for those whose interest is in the evolution of the great ideas of surgery there is also a great deal to be sought and savoured.

JAMES HARVEY YOUNG. *The Toadstool Millionaires. A Social History of Patent Medicines in America before Federal Regulation.* Princeton, New Jersey, Princeton University Press, 1961. xii, 282 pp., 16 illus. $6.00.

Reviewed by ALEX BERMAN, *Associate Professor, College of Pharmacy, University of Texas, Austin, Texas.*

THIS work is a notable contribution to the social history of proprietary medicines in the United States; its title is derived from O. W. Holmes's reference to the nostrum mongers of his day as "the toadstool millionaires." Chief villians of this study are Messrs. Perkins, Dyott, Thomson, Swaim, Brandreth, Hostetter, Helmbold, and Radam, whose operations encompassed more than a century of therapeutic skulduggery. There are two perceptive chapters on the promotion and psychological appeal of patent medicines. The crusading efforts of Samuel Hopkins Adams and Dr. Harvey W. Wiley on behalf of the American public, which did so much to secure the passage of the Pure Food and Drugs Act in 1906, receive a good share of the author's attention. Finally, in his epilogue, Dr. Young ruefully con-

cludes that despite the great transformations in medical practice, the tradition of the old quack and his victims is still very much alive on the contemporary scene.

Dr. Young has not attempted to evaluate the tremendous influence of patent medicines on the economic and professional development of the American drug store. It should be pointed out that the relatively large number of regular physicians who owned drug stores during the nineteenth century, especially before the Civil War, sold many of the prevailing nostrums.

The author recognizes that most nostrum promoters never became millionaires, that at times they were sincere but deluded people and not unmitigated knaves. He "casts a sad ballot against the gullible entrepreneur during the early years, when medical science and ethics were on unsure foundations and the line was hard to draw between the legitimate and the quack." To be sure, there were instances where the line was very thin indeed – historical contexts in which the chances of survival were greater with Bishop Berkeley's "Tar Water," with Rafinesque's "Pulmel," or with Raspail's camphor concoctions.

Dr. Young tends to overestimate the influence of O. W. Holmes on the therapeutics of his day. The author speaks of "Therapeutic Nihilism" in circumstances where the designation "therapeutic skepticism" would be more accurate. Moreover, it is highly questionable whether the doctors "who adhered to nihilistic tenets" were an important factor, as he implies, in driving people with the "medicine habit" to use patent medicines. There were just not that many "nihilistic" physicians. Indeed, "heroic" therapy persisted in this country longer than is generally realized. It will be recalled that when as late as 1863, Surgeon General Hammond ordered the removal of tartar emetic and calomel from the supply table of the army because these remedies were being pushed to extremes, the American Medical Association severely censured this action as a "reckless attempt to cut the Gordian knot of intricate pathology by the exercise of official power." And in 1878, the influential Dr. H. C. Wood of Philadelphia was still proclaiming the virtues of blistering, bloodletting, and calomel pushing.

The old Thomsonian movement which O. W. Holmes had called the "common sense scientific radicalism of the barnyard" is discussed at length by Dr. Young, but none of the other botanic sects are mentioned. Homeopathy, which Holmes characterized as "the scientific radicalism of the drawing room," is referred to in only one sentence in the book. Yet both the eclectic and homeopathic practitioners were actively engaged in promoting a widespread distribution of their own distinctive medications.

Nevertheless, within the compass of less than three hundred pages, Dr. Young has succeeded admirably in giving us a scholarly and well-written book on a significant aspect of American social history. This

work should have a wide appeal both to professional historians and the lay public.

FRIEDA SANDWITH. *Surgeon Compassionate.* London, Peter Davies, Ltd., 1960. viii, 235 pp., 10 illus., 21s.

Reviewed by DONALD P. SHEDD, *Associate Professor of Surgery, Yale University School of Medicine.*

THIS biography has been written by Frieda Sandwith, great granddaughter of Dr. William Marsden, founder of the Royal Free and the Royal Marsden Hospitals in London. Marsden was born in Sheffield in 1796. He ran away from home at the age of 19 to make his own way in London where he was able to earn himself a medical education. The author paints an interesting picture of the problems of a medical education in the early nineteenth century, including the necessary contribution of the body snatchers to the teaching of human anatomy.

Marsden qualified as member of the Royal College of Surgeons in 1827. He was struck by the plight of the poor in London who could not have hospital medical care unless their admission was sponsored by a letter from one of the governors of the Hospital. Under these circumstances many people were denied admission and as a consequence lost their lives for want of hospital care; some of them died in the streets. A turning point in Marsden's life occurred in 1828 when he found in a doorway a young girl critically ill and friendless. He was unable to have her admitted to any of the hospitals at that time because of the lack of the sponsoring letter from a governor. This led young Marsden to the firm resolve that he would found a new hospital where indigent individuals could be admitted free with no need for letters from a governor. Acting rather promptly, he established that same year the first free hospital when he was 31. The institution was called the London General Institute for the Gratuitous Care of Malignant Diseases. The early trials and tribulations of the hospital were staggering, both in the realm of political difficulties and great financial problems. On many occasions, deficits were met from Marsden's own purse. Among the problems faced by the institution were questions related to the morality of admission of patients with venereal disease. At this time the wards for the patient with syphilis were known as the foul wards. After a long, uphill struggle, the young institution was recognized in 1837 by Queen Victoria and permitted to call itself the Royal Free Hospital. Marsden's efforts in creating and sustaining this institution were of almost heroic proportions.

As if this were not enough for one life's work, Marsden undertook in 1851 to found a second hospital. This time the hospital was for the specific purpose of treatment of patients with cancer. There were difficulties in convincing the authorities of the need for such an institution, so that royal support was at first denied. In fact, a royal charter was not granted to the

institution until 1910 and it was not until 1936 that the hospital became known as the Royal Cancer Hospital. The contributions to knowledge of this institution devoted specifically to the care of malignant disease have been outstanding.

Mrs. Sandwith traces carefully all the events of Marsden's life, telling the story in an interesting and somewhat romantic fashion and livening it with her impressions of what probably took place rather than giving a simple factual account. She paints a most fascinating picture of both family life and medicine in the Victorian era. This reviewer would judge her research to have been of considerable depth and her reporting to be accurate.

It is a fascinating exercise to speculate about what motivates some men to labor so incessantly in the accomplishment of big and important things during their lives. At the time of his death in 1867, both of the institutions he had founded were playing vital roles in medical care in London. Marsden's life is an interesting demonstration of the fact that important contributions in medicine are sometimes made in the administrative realm rather than the scientific. This book is recommended as an interesting and informative account of the life of a significant human being.

W. SCHOLZ. *50 Jahre Neuropathologie in Deutschland, 1885-1936.* Stuttgart, Georg Thieme Verlag, 1961. 123 pp., illus. $3.50.

Reviewed by EDWIN CLARKE, *Visiting Associate Professor of the History of Medicine, Yale University School of Medicine.*

THIS slim, soft-backed book was presented to the participants of the International Congress of Neuropathology in Munich in 1959. It is thus comparable to the more substantial volume prepared for the Fourth International Neurological Congress in Paris, *Founders of Neurology,* published in 1953.

Each is entirely biographical, and the present work deals with German neuropathologists who illustrate the rise of pathology of the nervous system, not only in Germany but in the whole world. It devotes separate chapters to Weigert, Edinger, Kraepelin, Nissl, Alzheimer, Jakob, and Spielmeyer, and a final chapter to the neuropathologists in Berlin—the Vogts, Brodmann, Bielschowsky, and others. Each name is a household word, known for its association with a disease, an anatomical structure, or a histological stain or technique, and this array emphasizes the dominant role played by Germany in this field. As Dr. Ludo van Bogaert points out in the preface, the French school of clinical neurology, the Spanish school of neurohistology, and the British and American schools of neurophysiology provide further rough national groups. The period dealt with extends from 1885, when Weigert began his work at the Senckenbergisches Pathologisch-Anatomisches Institut in Frankfurt-am-Main, to the decline in the continuous and exuberant activity of German neuropathologists coincident with the rise of the Nazi regime.

This rapid development, which occurred later than in other parts of pathology, found its origin in a number of factors such as the increase of knowledge concerning the microscopic structure of the normal brain, the advance of clinical neurology, the introduction of neurological surgery, and the discovery of new techniques for examining nervous tissue in health and in disease. It was in the latter that the Germans predominated.

The authors of the individual chapters are all outstanding men, and they themselves have contributed to the progress of neuropathology. They give accurate and, in most instances, well-documented biographical sketches occasionally supplemented by their own reminiscences. One may question the necessity of repeating biographies already available elsewhere; seven of the subjects are included in *The Founders of Neurology*, and five are in Kurt Kolle's *Grosse Nervenärzte* (Stuttgart, 1959, vol. 2, pp. 12-64); Kraepelin's biography is in Volume 1 (Stuttgart, 1956, pp. 174-186). But it is important that these men should be discussed together, and the editor has wisely allowed Kraepelin to join them. It was he who, after initial doubts, foresaw the increasing importance of neuropathology, and his efforts to further its development tended to counterbalance the opinions of other investigators of mental disease who insisted that the psychological approach to it was the only one possible. His colleagues and pupils include Alzheimer, Nissl, Brodmann, Spielmeyer, Jakob, and von Economo; they are a clear indication of his influence, which, as Dr. Kolle emphasizes, was international as well as national. There is in fact new material in each chapter, including letters of Weigert and of Alzheimer, as well as photographs of laboratory groups which are also a useful addition.

The authors wisely elected to confine their detailed attention to a few rather than to many contributors to the fame of German neuropathology and thereby kept their book from degenerating into a list of names. Nevertheless, the book would have benefited from the inclusion of a final analysis of the distinctive German contribution to neurology.

U.S. National Library of Medicine. *Early American Medical Imprints: a Guide to Works Printed in the United States, 1668-1820*, by Robert B. Austin. Washington [Government Printing Office], 1961. x, 240 pp. $1.00.

Reviewed by Lee Ash, *Editor,* American Notes & Queries, *New Haven, Connecticut.*

Historians and students of American medicine, collectors of books about medical development in almost all fields, and antiquarian bookdealers, as well as librarians everywhere, will be extremely grateful to the National Library of Medicine for this publication which has been many years in the making. The book stands as a guide to the earliest and sometimes crudely recorded literature of *medicine* in the broadest sense of the word, and the classes of works excluded by the compiler will disappoint very few. Here,

then, we have a nearly complete record of American printings of medical works available to the physician, the midwife, the home nurse, in some of the most crucial years of a period which shaped attitudes toward the approaching era of more scientific medical practice. The books listed here are of greater interest for their mirroring of contemporary medical thought than for their printing history, although many of them are of some bibliographical importance as "firsts" or because of their author's intellectual contribution to medicine or some other field.

This fine and delightfully inexpensive volume will, perhaps, be used most for comparisons of bibliographical data and the location of copies for research purposes. Of course some users will seek an opportunity to cite a work as "Not in Austin," while others (certainly many more) will want to give the Austin number to pin down a reference. All this and more one will be able to do with facility since the book provides a completely competent, consistent, and reliable pattern of bibliographical form throughout. It also supplies a good deal of unexpected reference apparatus, such as frequent citations of authors' birth and death dates, notes about the history of a publication, or contents notes. There is a Chronological Index to entries (which are arranged alphabetically, in the body of the work, by author from "A., R. *See* Jones, Absalom . . ."—while the first numbered item is Abeel, David G.—to 2106, Zollickoffer, William), and titles are transcribed following the exact punctuation "wherever possible, but not capitalization or other typographical features. . . ." Cross-references are better than adequate, and simple collations are given with sufficient information for most purposes; size is rendered in centimeters.

Mr. Austin has cited Evans and Sabin numbers, and he has added an unusual Appendix of ghosts from Evans, ". . . books not included in the present work. Some could not be verified as having been printed while others may exist but copies of them were not located." Historians and bibliographers will look forward to reports of the discovery and location of these in the future, and we hope that a supplementary publication will have references to them, along with a subject index to the whole book.

It is inevitable that such a volume as the Guide would suggest other special uses; for example, would it not be interesting to analyze the contents, book by book, to learn the proportion of original American publications, reprints of British volumes, and translations from other languages (whether first printed in America or abroad). But Mr. Austin, and the libraries which reported their holdings to him (and are cited after each entry), have given us a most helpful tool of a kind that has become a familiar form of bibliographical control. Anyone who browses through the book will be rewarded with new knowledge beyond its apparent reference values, and the list is certain to stimulate an appreciation of the titles included. One hopes that it will also send new collectors to an interesting representation of the earliest period of American medicine.

LOUIS KAPLAN. *A Bibliography of American Autobiographies,* compiled in association with James Tyler Cook, Clinton E. Colby, Jr., Daniel C. Haskell. Madison, the University of Wisconsin Press, 1961. xii, 372 pp. $6.00.

Reviewed by GERTRUDE L. ANNAN, *Librarian, New York Academy of Medicine.*

MAN's preoccupation with his own life is well demonstrated in this list of 6,377 autobiographical publications. The compilers have searched many bibliographies and checked the holdings of a number of American libraries, chiefly public and university libraries, and libraries of divinity schools and historical societies. Its appeal, then, is more to the general historian than to the medical historian, although the latter can use it with profit to find little-known pieces written usually by obscure physicians and surgeons, and for background material in non-medical sources.

The entries, alphabetically arranged, show the author's main career, his period, and locale. The contents are made easily available by a detailed subject index. For the medical historian there are entries under Alcoholics (24), Doctors (nearly 200), Illnesses (13), Medical journalists (3), Mentally ill (28), Missionaries, Medical (31), Narcotics addicts (11), Nurses (18), Civil War nurses (14), Physically handicapped (44), Sexual deviates (3). Other subjects of potential interest to the medical historian include: Criminals, Juvenile Delinquents, Prisoners, Scientists, Slaves, Social Reformers. The index is helpful, too, in providing geographical sections with subdivisions such as: Doctors, Farmers, etc. Immigrants, Indians, Civil War, Pioneers, pinpoint personal reminiscences and experiences of various kinds. The historian seeking a description of a physician's life in the mountain states will find two entries under: Mountain. Doctors. Those entries which have many references have chronological subdivisions.

It is obvious that this book can offer many types of autobiography to serve the historian's needs. The medical historian, however, cannot fail to note the omission of a number of titles. In general the earlier periods are more fully covered than the later. The following titles are some of those not found under A or B. E. H. Abington, *Back Roads and Bicarbonate, the Autobiography of an Arkansas Country Doctor.* New York, Vantage Press, 1955; Donald T. Atkinson, *Texas Surgeon; an Autobiography.* New York, Washburn, 1958; Emily D. Barringer, *Bowery to Bellevue . . .* New York, Norton, 1950; Paul B. Barringer, *The Natural Bent: the Memoirs . . .* Chapel Hill, University of North Carolina Press, 1949; Marcus Bossard, *Eighty-one Years of Living,* Minneapolis, Midwest Printing Co., 1946; Mary W. Brinton, *My Cap and my Cape; an Autobiography* [of a nurse]. Philadelphia, Dorrance, 1950; Jacob L. Bubis, *Women are my Problem, the Autobiography of an Obstetrician and Gynecologist,* New York, Comet Press, 1953; William H. Bucher, *Surgeon Errant, The Life and Writings of,* Los Angeles, Angelus Press, 1935.

As the introduction points out, some classes of materials were excluded, among them "most episodic accounts, such as those relating to Indian captivities, military imprisonments." Yet there seems considerable variation in the application of this rule. It seems surprising to find Waterhouse, *A Prospect of Exterminating the Small Pox,* 1800-1802, because it contains his experiments on vaccination, and not his *A Journal of a Young Man of Massachusetts,* 1816. The latter certainly is episodic, as is the former, and also L. V. Briggs, *Experiences of a Medical Student in Honolulu . . .* 1881, Boston, 1926, no. 661, and C. C. Byrne, *Reminiscences of an Army Surgeon, 1860-1863,* no. 864. Some military journals not in the bibliography are Alfred L. Castleman, *The Army of the Potomac . . . a Diary . . .* Milwaukee, 1863; Jacob R. Motte, *Journey into Wilderness; an Army Surgeon's Account . . .* 1836-1838, Gainesville, 1953; Caleb Rea, *The Journal of . . . during the Expedition against Ticonderoga* in 1758, Salem, Mass., 1881; and James Thacher, *A Military Journal during . . . 1775-1783,* Boston, 1823. It is perhaps quibbling to point these out, for many decisions for inclusion or exclusion in a work of this scope can be questioned. We should be grateful to the compilers for the excellent source book which will serve a wide audience.

JOHN L. THORNTON; AUDREY J. MONK, and ELAINE S. BROOKE. *A Select Bibliography of Medical Biography.* The Library Association, London, 1961. 112 pp. £1/7/6. (Library Association Bibliographies, 3).

Reviewed by GERTRUDE L. ANNAN, *Librarian, New York Academy of Medicine.*

THIS attractive small volume includes over fifty collective biographies and more than seven hundred individual medical biographies, with occasional individual bibliographies. It is limited to those in the English language, published in the nineteenth and twentieth centuries. The book should appeal especially to the physician or the librarian of a small collection not interested in procuring works in other languages, but it is surely an inexpensive and useful addition to any collection. Arranged alphabetically under the subject of the biography, each entry usually supplies his dates and a short statement concerning him, from a brief "Canadian surgeon" (Shepherd) to "Physician Accoucheur to St. Bartholomew's Hospital London; associated with Sir James Young Simpson in discovery of anaesthetic properties of chloroform" (Duncan).

In such a selective list it would be futile to cavil about the inclusion or exclusion of any items. The fact that this work was compiled by three librarians shows that decisions were not made on the basis of the preference of one person. The reader, however, will certainly wish that the compilers had cited the number of pages and given some indication of the type of biography, whether definitive, scholarly, popular, or juvenile. Such advice would be particularly helpful when there are several entries for one man. The volume is well edited and printed, a pleasure to use, thanks to generous

leading, bold face type for the names of the biographees, and easily readable type—a most refreshing change from the eye-fatiguing products of new methods of automation. Errors have been kept to a minimum. Two may be cited here. Elizabeth Thomson, joint author with Dr. Fulton of a biography of Silliman (p. 97), is also the author of the Cushing biography on p. 37 where her name is given as Thomas. William S. Bryant's middle name is Sohier, not Shoier (p. 31).

Librarians and historians alike have long felt the need of knowing more of the contents of biographies than their titles show. Perhaps some tireless librarian will one day embark upon an index by place, period, and specialty. How helpful it would be to have a source for medical education or practice in a particular time or place. Librarians, frequently asked for such information, would value a key to such untapped resources.

PAUL DIEPGEN. *Unvollendete. Vom Leben und Wirken frühverstorbener Forscher und Aerzte aus anderthalb Jahrhunderten.* Stuttgart, Georg Thieme Verlag, 1960. 223 pp.

Reviewed by BRUNO KISCH, *Curator, Edward Clark Streeter Collection of Weights and Measures, Yale Medical Library.*

THIS book contains short biographies of thirty-three scientists who had made valuable contributions to the advancement of medicine and science before they had the misfortune to die at an early age. No less than sixteen of them ended their lives by suicide.

There is no question that for everyone interested in the history of science and medicine carefully written biographies like those presented in this book are highly informative, and therefore this volume by Paul Diepgen will remain a valuable reference item despite the fact that more or less extensive biographies of many of these persons already exist. The thirty-three life stories, it must be emphasized, are not based on archival research and critical new evaluations of the work of these men, but are short accounts extracted from already published biographical material. It seems to this reviewer that there is nothing typical or unusual in the early death of these scientists that distinguishes them from people of other professions except in the few cases where the profession itself, as in the case of Edmund Weil, was the reason for death. Therefore, there seems no special merit in selecting the thirty-three biographies from this viewpoint except sympathy for gifted people who died too early to fulfill their evident potentialities.

It might be much more enticing and fruitful for human psychology to study the biography and errography of scientists who had to fight the obstructive influences of malevolent enemies and to tell how they continued with their work despite such adversities, as this reviewer tried to do in his biographies of Valentin, Gruby, Remak, and L. Auerbach. Perhaps Diepgen with his great knowledge and skill will some day write a group of

biographies of gifted scientists who were stopped in the midst of their careers by German Nazi terror, but who nevertheless tried to continue their dedicated work for medicine and mankind. This reviewer has no doubt that they have no less poignancy than the biographies of scientists who died at an early age.

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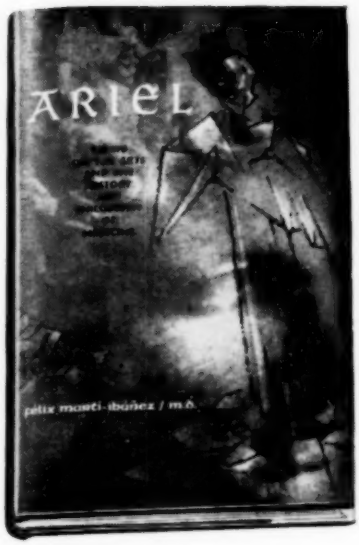

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